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The Shadow Economy in International Comparison: Options for Economic Policy Derived from an OECD Panel Analysis

Ulrich Thießen[1]

Abstract

Building on new behavioral and institutional theories, using a data set of about 450 variables and augmenting the Sala-i-Martin definition of robustness, we find evidence in support of the hypothesis that the standard causes of the shadow economy (SE), taxes, the administrative burden and labor market regulations, are not per se crucial in determining the size of the SE. There are many other influences with a consistently estimated plausible sign and whose quantitative impact appears to be even larger and more significant than that of the standard causes. Many of the robust influences emanate from relatively new theories such as elements of direct democracy, social interaction effects, moral aspects, and happiness, and from the institutional literature on the relative importance of specific institutions for economic performance. Most of them can well be influenced by governments. Hence, in order to reduce the SE and tax avoidance, a coordinated international strategy of using incentives to work, save, and invest in the official economy, including the behavior of the government, could be more successful than a strategy built on more government control, increased punishment and less freedom. The latter strategy would contradict the new theories and our evidence but appears to have been adopted by some OECD countries. Simulations of the size of the SE demonstrate their sensitivity to required velocity assumptions and show that previous estimates, including those of the so-called Mimic model, appear to be based on the very high end of possible velocity assumptions. Relatively low velocity assumptions can be defended much better and yield macro estimates of the SE consistent with the micro evidence. Finally, for the first time we separate the relatively large "criminal" shadow activity from the "non-criminal" one.

JEL Code: C23, E61, H26, O17

Keywords: shadow economy, currency and mimic method, policy response

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Contents

1 Introduction

Research on the shadow economy (SE) grew tremendously during recent years and there are at least two important reasons:
- In times of pressure on public finances in industrial countries due to relatively low economic growth, persistent unemployment, aging, and widening inequality of income under globalization, politicians increasingly criticize tax avoidance, unofficial labor and "unsocial behavior" and implemented measures to increase effective auditing and control of economic activity, raised the punishment level for tax violations and pressured countries with liberal tax laws to abolish their bank secrecy laws and provide information on foreign bank accounts.
- Economic research extends more and more into the area of morality, social norms, social capital, and happiness, and finds strong evidence in experiments for social interactions such as pro-social behavior, reciprocity and fairness effects (e.g. Fortin et al., 2007, Carpenter and Matthews, 2004, Dohmen et al., 2009 and the overview by Riedl, 2010).

However, despite this rapid growth there are important gaps in the SE literature which this paper attempts to address:
- A distinction between the organized crime related and the other SE is not made, although this would be needed to make policies effective.
- The empirical literature assumes few major standard causes of the SE, i.e. the tax and social security burden and the regulatory burden, often augmented by selected variables of interest such as specific institutional indicators, indicators of moral aspects etc. But regarding the standard causes it would be valuable for policy purposes to know in detail, which taxes and regulatory aspects are relevant and what their relative quantitative impact is compared to other influences. Thus, we aim for a systematic overview of institutional characteristics and other potentially relevant influences showing the quantitative influence in each case.
- Hypotheses of conditional effects appear especially relevant in SE analyses because taxes, for instance, may well promote the SE, but this may depend on other factors such as the satisfaction of tax payers with the quality of public services they receive. This suggests testing for conditional effects through interaction models or other means, which are, however, lacking in empirical analyses of the SE.
- In analyses that derive relatively high estimates of the ratios of the SE to official GDP often a discussion of the required assumption regarding velocity of currency used in the SE and of the sensitivity of the results to this assumption is missing as is exact information about the assumed velocity and the underlying estimated currency demand equations. Since relatively recently there has been a rebirth of the so-called MIMIC models in producing estimates of the SE (i.e. structural equations models employing selected multiple indicators and multiple causes of the SE, see, for instance, Breusch, 2005a). They yield an index of the estimated size of the SE whose transformation into actual ratios to GDP requires benchmarks of the size of the SE, which usually come from estimated currency models. While these papers usually present the estimated coefficients of the Mimic model, the estimated currency equations are not shown on which the results are ultimately based. Thus, we need to say which velocity assumption we make, discuss it, and show how sensitive the results are to it (see also Angrist and Pischke, 2010). Otherwise the incorrect impression in the public could be solidified that currency demand or Mimic models enable the economic science to provide a rather precise estimate of the size of the SE for each country.

Hence, the emphasis in this paper is primarily on identifying as detailed as possible the many influences on the SE for policy purposes. The estimates of the size of the SE serve to demonstrate their fragility and sensitivity to velocity assumptions. Moreover, we ask which velocity assumption makes the macro estimates compatible with the extensive and growing micro evidence on the size of the SE. The latter tends to yield much lower estimates than many of the papers that use the currency or Mimic model. We find that the micro- and macro-evidence become consistent when assuming a relatively low but "normal" velocity (such as that of M2) and that the latter can be much better defended than a high velocity. Moreover, the critique of relatively high estimates of the SE is

increasing and this resulted in subsequent corrections by authors. For instance, for Australia estimates of the SE of about 15% of official GDP by an experienced analyst were corrected and new estimates delivered which were up to two thirds less than before. But these were again criticized as flawed and too high due to double counting, after which the new analysis was withdrawn from publication (see Breusch, 2006).

The remainder of the paper is structured as follows:

The following section 2 provides an overview of theories of the SE as the basis for the discussion of the estimation results. Section 3 describes our data and estimated models. Section 4 presents the empirical results with regard to the analyzed influences, estimated sizes of the SE and their sensitivity. In section 5 we use the results for proposing policies that should be effective in reducing the SE even if the overall evidence suggests the SE to be substantially smaller than often assumed, and section 6 concludes.

2 Overview of theories of the shadow economy

In order to systemize our analysis we propose a structure of 7 major categories of influences. The structure is used for an overview of theories, then to collect the needed data (see the variables collected in appendix 1) and also to present the estimated results.

Our first category are constitutional aspects followed by the two standard presumed causes, namely, second, the tax and social security burden and, third, the administrative burden. Fourth is the quality of the administration and justice system, fifth is the group of economic institutions (property rights vs. contracting institutions, organization of the labor market, enforcement measures), sixth is values and moral aspects, and seventh is other influences and subjective factors.

For reasons of space we rely on very brief summaries in the table highlighting main theoretical hypotheses and, if existing, associated formal models and empirical results. Also to save space we exclude the relatively young literature concerning interactions between the SE and the official economy.

The overview shows the following:

- with the exception of categories one (constitution) and six (vales/moral), where theory predicts a negative sign for the SE if the characteristic under question is improving, many of the theories yield ambiguous results, and
- for a considerable range of theoretical hypotheses a formal theoretical model is still missing. In other words, although there has been much recent growth of the theoretical literature, there is still much room for theoretical models to be developed regarding specific hypotheses.

Table 1
Theories of causes of and influences on the shadow economy (SE)

Category	Cause	Theoretical model (examples)	Main result or hypotheses	Empirical result
1 Constitution	Democratic system	Rivera-Batiz (2002)	Democracy promotes growth of formal economy, particularly through less corruption	SE: ↓, Rivera-Batiz (2002)
	Elements of direct democracy	no formal model	More direct political participation (especially "financial referenda") tends to raise tax morale. Frey (1997), Slemrod (2003), Torgler (2005), Frey and Torgler (2007)	SE: ↓, e.g. Swiss cantons, Feld und Frey (2002), Torgler (2005).
	Participatory democracy (Voters select among proposals of ruling local government. The latter implements the decision. Example: City Porto Allegre in Brasil).	Aragones & Sanchez-Pages (2009)	Advantage vis-a-vis: a) direct democracy: better mechanism to implement policies b) representative democracy: better information for lawmakers about preferences of the median voter	SE: ?
	Political stability	no formal model	Political stability may dampen SE	SE: ↓, Torgler and Schneider (2007)
	Minority rights	no formal model	Consideration may reduce etnic tensions and promte integration	SE: ↓
2 Tax- and social security burden	- average, - direct, - indirect tax- and social security burden	Musgrave (1959), Petersen (1982), Davis & Henreksen (2004)	Changes in tax burden cause: - income effect + - substitution effect. They work in opposite direction regarding labor supply, savings, investment. But if unemployment is high and tax burden is increased, income effect may dominate => SE ↑, Additional effects: - „spite" effect, „reciprocity", tax evasion ↑, => SE ↑	Majority of studies: SE ↑, e.g. Schneider (2005) for 110 countries, Davis et al. (2005) for 20 OECD countries with high per capita income; but also: SE ↓ or no effect, e.g. Friedman et al. (2000) for 69 countries
		Allingham & Sandmo (1972)	Simple „Cost-benefit calculation": Optimal SE or tax evasion depends upon: - probabilty to be detected, - degree of punishment, - degree of risk aversion. Weakness: - no intrinsic motivation, - model can explain tax evasion only when assuming unreasonably high degree of	Presumes SE and tax evasion! But in certain countries the SE/ tax evasion id relatively small (e.g. Switzerland) despite relatively low level of controls and fines. Tax reform in Russia 2001: SE/ tax evasion ↓ (cannot be

			risk aversion - income exogenous; no relation between income generation, disutility of labor, and tax evasion	explained with increased controls and punishment, Grodnichenko et al. 2008)
		Dzhumashev & Gahramanov (2008) , Lin & Yang (2001), Yitzhaki (1974)	- Higher punishment => SE and tax evasion ↓, - when there is SE and tax evasion: optimal government size ↓, - t ↑ => SE ? (theoretical result ambiguous)	Effect on SE of punishment and size of government unclear, t ↑ => SE unclear, see above
	- marginal, - direct, - indirect burden of taxes and social security contributions	Isachsen & Strom (1980), Anderson (1977)	Separation of formal and informal labor supply => income becomes endogenous: marginal tax rate ↑ => formal labor supply ↓ and informal labor supply ↑	t ↑ => SE unclear, see above
	Progressivity of the burden of taxes and social security contributions	Neck, Schneider Hofreither (1989), Sandmo (1983)	Progressivity ↑: formal labor supply ↓, risk taking ↑ => SE ↑	SE: ↑
		no formal model	Hypothesis: High marginal income taxation in young age of single-households causes: - „spite“ effect, - interest in tax evasion, which -if once inspired- continues	SE: ↑
	Complexity of the tax system	Schneider & Neck (1993)	- Complexity ↑ => SE ↓ owing to legal tax avoidance, e.g. use of tax loopholes; Further hypotheses (no formal model): - Complexity increases uncertainty, unfairness, and undermines the constitution (e.g. when tax laws are out of reason, unclear, and/or when judicial decisions in tax matters depend e.g. on the region of the court); - Complexity promotes unequal income distribution and dampens tax progressivity.	for Austria: following tax system simplification: Complexity↓ => SE ↑ (Schneider und Neck, 1993). for Ukraine: complexity↑ => SE ↑ (Thießen, 2003)
	Taxation of nominal capital income (e.g. - taxation of nominal interest income at the source - profit taxation without adequate conideration of the cost of own capital)	Boadway & Bruce (1984), Rose & Petersen (2004), Nguyen & Rose (2004)	- Distortion of saving/ investment decisions, - high effective or even expropriative taxation (when taxes exceed earned real income), - from an intertemporal viewpoint the saver is taxed higher than the non-saver at same lifetime income (avalanche effect of taxation).	SE: ↑ ?
	No recognition of other objective costs (e.g. limited recognition of borrowing costs)	no explicit formal model	same as previous	SE: ↑ ?

3 Adminis-trative burden	Intensity of regulation regarding enterprises and employees	Johnson et al. (1997), Frey (1977), Brunner (1978)	- Formal activity may be hindered by an increasing number of laws and administrative rules; - more regulation harbors risk of more corruption; - with increasing size, the government becomes less efficient (caused, for instance, due to a production function with decreasing economies of scale and/or a bureaucracy which pursues its own goals).	SE: ↑ Friedman et al. (2000)
4 Quality of administra-tion and justice system	Quality of administration	no explicit formal model	Dissatisfaction with quality of public goods and services ↑: SE ↑	SE: ↑ Friedman et al. (2000)
	Independence and objectivity/impartia-lity of the justice system	Glaeser et al. (2000)	De-facto independence of prosecution from executive authority => incentives for prosecution to proceed against malpractice & corruption ↑ => corruption ↓	SE: ↓ ? de facto indepen-dence of justice system ↑, corruption in government ↓ , Aaken et al. (2008)
5 Economic institutions	"Property rights institutions" versus the relative role of "contracting institutions" (which support private contracts)	Acemoglu & Johnson (2005)	"Protection of property rights" appears to be quantitatively more important than "contracting institutions" in determining economic performance (growth of official GDP and the quality of institutions): SE: ↓	SE: ↓
	Labor market regulation	SE is commonly analyzed from the perspective of the regulation of the labor market, e.g.: Tokman (1992), Loayza (1997)	- Excessive regulation and taxes (with weak enforcement) => labor costs ↑ + excessive demands on the supply of public goods => SE ↑	SE: ↑ ?: but high SE in countries with relatively flexible labor market (e.g. Mexico), and movement of formal to informal labor not only during recessions but during boom periods, e.g. Maloney (1999, 2004). = contradiction to many labor market models
		Sorting: Boeri & Garibaldi (2005)	- above all less qualified workers work in the SE, - SE is to some extent being tolerated by the government to dampen unemployment, - more controls and punishment will only increase unemployment, - deregulation of labor market is required	For OECD countries there is a high positive correlation between SE and the non-employment rate. Further evidence: Brasil and particularly Italy in Boeri und Garibaldi (2005)
		Equilibrium search and matching models: e.g. Mortensen &	Assumes existence of shadow economy even when there is no taxation. Decision for informel work	But high SE exists also in countries with very flexible labor market (e.g. Mexico),

		Pissarides (1994), Boeri & Garibaldi (2002), Albrecht et al. (2006), Bosch & Pretel (2006)	mainly determined by productivity of economic agents. Productivity, in turn, is determined by human capital (education).	and movement from formal to informal work also in boom periods e.g. Mahoney (1999, 2004).
	Flexibility of wage formation	no explicit formal model but influence of regulation analyzed in Johnson et al. (1997)	Hypotheses: High flexibility: labor costs ↓: unemployment + SE↓, but if wages are highly volatile: SE ↑	SE: ↑ ↓ ?
	Fixed costs for hiring and firing	no explicit formal model	Hypotheses: High fixed costs: labor costs ↑: unemployment + SE ↑, but if hire & fire policy: SE ↑	SE: ↑ ↓ ?
	Minimum wage	no explicit formal model	Hypotheses: if minimum wage is higher than marginal product of labor: unemployment ↑ + SE ↑ ; if minimum wage increases income => search for informal employment ↓ => SE ↓	SE: ↑ ↓ ?
	Labor market programs for unemployed	no explicit formal model	Hypotheses: - unemployment ↓, SE ↓ , - no influence on SE, - labor cost ↑, unempl. + SE ↑ ,	SE: ↑ ↓ ?
	Training for unemployed	no explicit formal model	- Productivity ↑, unemployment + SE ↓ - labor costs ↑, unempl. + SE ↑	SE: ↑ ↓ ?
	Labor participation rights	no explicit formal model	Hypotheses: - better integration of workers in the system and in enterprises - better produktivity of employees: less incentive to work informally - better management and more success => SE ↓ - Strengthening of long term interests vis-a-vis fincial investors with short term interest OR - higher costs, slower decisions, less success => unemployment ↑ => SE ↑	SE: ↑ ↓ ?
	Proft sharing	no explicit formal model	Same as co-determination	SE: ↑ ↓ ?
	Punishment and controls	Becker (1968)	From viewpoint of social welfare is the maximum level of punishment always optimal, because fines cause no cost in contrast to controls => Maximum punishment desirable.	Maximum fine for activity in SE/tax evasion not observable. In several countries the level of punishment and controls risis.
		Davidson et al. (2004)	Market imperfections (e.g. at the capital market, asymme-trical informations) can reduce the optimal (maximum) level of punishment. Optimal	In OECD countries very different levels of punishment for SE/tax evasion, although market

			punishment is lower than ist maximum degree.	imperfections are not as diverse
		Tyron & Feld (2005), Slemrod (2007)	Elements of direct democracy can reduce the optimal level of punishment => optimal degree of punishment lower than maximum degree	Switzerland: relatively low SE size despite rel. low level of punishment for tax law violations (tax avoidance is no criminal offence). Frey and Feld (2002) Switzerland: participation rights ↑: tax morale ↑
		no explicit formal model but Fees and Wohlschlegel (2019)	Hypothesis: Punishment ↑: „crowding out" of the intrinsic motive for tax honesty through extrinsic motive, dependent upon tax and regulatory burden, supply and quality of public goods and services, etc.=> SE ↑	Punishment (conditional) ↑: SE ↑ ? Feld and Larsen (2006) for Germany: no significant negative effect of higher controls and punishment on the SE.
6 Values/Moral	Social Capital / Trust	no explicit formal model	Voluntary membership and collaboration in organisations increases sense of respon-sibilty for the community/ society (Putnam 2000); Trust –between strangers- lowers transaction costs	SE: ↓ ? For US: Dincer & Uslaner (2009): Trust promotes official economic growth and manufacturing employment
	Tax morale	Frey (1997), Slemrod, J. (2003), Kannianen, Pääkönen, Schneider (2004)	Tax morale = intrinsic motive for honesty tax morale ↑ = SE ↓	SE: ↓ ? Feld and Frey (2002, 2004), Torgler (2003), Frey and Torgler (2006), Torgler and Schneider (2007),. Tax morale is influ-enced by age, edu-cation, employment status, religion, qua-lity of political insti-tutions: Alm and Tor-gler (2006) and Frey and Torgler (2007). Moral suasion has no influence on tax mo-rale (Torgler, 2004)
	Religion	Kannianen, Pääkönen (2007)	Culture and religion influence morale and tax honesty	no influence of religion on tax morale in Europe (catholic south vs. protestantic north), Kannianen, Pääkönen (2007)
	Social norms and interactions	Fortin, Lacroix and Vileval (2007): = Allingham-Sandmo-Yitzhaki Modell with social	Tax honesty is influenced also through social interactions: - conformity - reciprocity - fairness	Evidence for social interactions in experiments: significant are: - reciprocity and

		Interactions Cappelen et al. (2010), Fischbacher & Gächter (2010)	 Little evidence for people being purely self-interested or for education making them more self-interested. Fairness considerations tend to increase with age and work experience. Only a minority is motivated by income-maximization alone but people are imperfect conditional cooperators and tend to become income-maximizing free-riders.	- „fairness“ Effects: e.g. Fortin et al. (2007), Carpenter and Matthews (2004), Dohmen et al.(2009), Cappelen et al. (2010), Fischbacher & Gächter (2010)
	Corruption	Choi & Thum (2005), Johnson et al (1997)	Choi and Thum (2005): SE offers possibility to avoid corruption and dampens distortions caused by economic policy => SE is substitute for corruption und SE promotes official economy (= SE is complementary to official economy). Johnson et al (1997) : SE and corruption are complementary; SE is a substitute for official economy. Dreher & Schneider (2006): in countries with high income: SE and corruption are substitutes; in countries with low income: SE and corruption are complementary.	Corruption ↑: SE: ↑ , for 49 countries Johnson et al. (1999), However for high per capita income countries, Dreher & Schneider (2006): Corruption ↑: SE ↓, (SE is substitute for corruption und complematary to official economy); in low per capita income countries: Corruption ↑: SE: ↑ (SE and corruption are complementary and a substitute for official economy)
7 Other influences and subjective factors	Globalization	no explicit formal model	Increasing competition on goods- and factor markets raises uncertainty of income and employment	SE: ↑ ?
	Unemployment/ under-employment	Dell'Anno and Solomon (2008)	unemployment => SE ↑	SE: ↑ , for USA: Dell'Anno and Solomon (2008)
	Inequality of the income distribution (several definitions are possible: e.g. in a society, between woman and men, etc.)	Chong and Gradstein (2007)	Inequality results in disadvantages for groups with low income if institutional quality and protection of property rights is relatively low. These groups will then work in the SE where they can retain their full production.	SE: ↑ , Chong and Gradstein (2007)
	Decentralization of economic policymaking	Brennan & Buchanon (1980) Prud'homme (1994)	Leviathan restraint hypothesis: Decentralization (horizontal and vertical competition of governments) may prevent revenue maximizing behavior of government => SE ↓ Decentralization results in lower quality of government decisions, more corruption, and increased influence of interest groups => SE ↑	SE: ?

	Quantity und quality of public goods and services	Johnson et al. (1997)	Satisfaction increases tax morale and dampens SE	SE: ↓ ?
	Efficiency of public goods supply	no explicit formal model	Inefficiencies of public goods supply assumed or observed by taypayers dampen the tax morale => SE ↑	SE: ↓ ?
	„Fairness“ of tax system/ social law	see complexity of tax system	e.g.: - impossibilty to use tax loopholes with a relatively low income, - disregard by tax laws of certain costs/risks in calculated profits and applying a relatively high marginal tax rate, - dependence of court rulings in tax matters on the location (region) of the court etc.	SE: ↑ ?
	„Fairness“ of remuneration	no explicit formal model	„Fairness“ effect, reciprocity = > SE ↑	SE: ↑ ?
	Influence of woman	no explicit formal model	Hypothesis: more influence of women in politics and enterprises may reduce risk taking and increase fairness: SE ↓	SE: ↑ ↓? Woman pursue tax avoidance less (e.g. Baldry 1986)
	Treatment of taxpayers through tax authority	Akerlof (1982), Osterloh and Frey (2000)	Implicit „psychological contract“ between tax authority and taxpayer owing to – in particular- participation rights (elements of direct democracy)	Feld und Frey (2002) Switzerland: tax offenses are negatively influenced by an index of “direct democracy”
	Conduct of state representatives, including “constitutional crisis” if the executive branch undermines decisions by the judiciary	no explicit formal model	e.g.: - poor control of enterprises/banks owned by the government => losses; - tax increases or old-age pension cuts with preferential treatment of certain groups such as civil servants; - excecutive branch applies court rulings only to the individual that won the case even if the ruling has general meaning; - excecutive branch prevents such court decisions by mutual agreement with the taxpayer who filed the complaint; - executive branch and legislature implement a fee or tax despite significant probability that higher courts will later rule against it.	SE: ↑ ?
	Conduct of executive boards of enterprises, supervisory boards, financial investors	no explicit formal model	examples: - short term profit maximization with adverse long run effects for the company; - insufficient control of executive boards through owners and supervisory boards;	SE: ↑ ?

			- flawed, uncoordinated strategy pursued by executive board; - little acceptance of laws, - dubious open or hidden profit distribution and dubious royalties.	

Source: own compilation

3 Data, definition, and models

Our data set includes a maximum of 38 countries, which are all OECD countries and eight Eastern European countries[2]. We use the OECD data base for standard macroeconomic variables[3] and the IFS and ECB statistics for monetary aggregates. Proxies for the variables of the seven major groups defined above of causes of and influences on the shadow economy are shown in Appendix 1, "indicators and sources". This table provides a somewhat more detailed breakdown of the seven major groups of variables compared to table 1, because data are available regarding some potentially relevant influences on the shadow economy even where a theoretical hypothesis or model has not yet been established. For instance, this refers to the fifth major group "economic institutions" regarding particular labor market characteristics and the innovation potential of countries, and it refers to the seventh group (other influences and subjective factors), where data are available on political decentralization, globalization, gender, feelings and expectations, financial secrecy, and aging.

Regarding indicators of the shadow economy, this study aimed at using alternatives to the most used indicator, currency in circulation relative either to the population or to M2. These alternatives are shown at the bottom of the table of appendix 1.

However, the first shown variable, the estimates of Schneider (2007), cannot be used because they were derived on the basis of currency regressions.[4]
The third indicator, the 'world economic forum' survey of the size of the informal sector assessed by enterprise executives in a large number of countries (wef616), is available in most cases for the years 2000-2005 but after changing its scale in 2004, which was then inverted in 2005, the indicator was dropped completely without replacement. Apparently there have been problems with this indicator and it has a low negative correlation with estimates of currency per capita.
The fourth and fifth indicator by the world value survey ('cheating on taxes justifiable', f116b) and Fraser Institute ('extra payments/bribes', f5n), respectively, also have very limited observations because for the considered period 1991-2007 the world value survey performed only up to a

[2] The countries are Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States plus eight Eastern European EU countries Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Slovak Republic, and Slovenia.

[3] This includes GDP, GDP in PPP, population, price indices, various employment, non-employment and unemployment measures, interest rates etc.

[4] Increasingly, estimates of the SE are based on the use of so called MIMIC models (i.e. structural equations models employing selected multiple indicators and multiple causes of the SE). But these models yield an index of the estimated size of the SE whose transformation to actual ratios of the SE to GDP requires benchmarks of the size of the SE. These benchmarks are usually taken from Schneider (2007) or earlier papers by Schneider where he shows estimated ratios of the SE to official GDP based on currency regressions. Therefore, the results of MIMIC models are ultimately based on currency regressions. However, one cannot find the estimated currency equations. Only shown are estimated ratios of the SE to official GDP. See also Breusch (2005a) for an elaboration of this issue and MIMIC models to estimate the SE.

maximum of four surveys and the Fraser indicator is available only for 1995 and the years 2000-2005. In addition, these indicators have a small and negative correlation with per capita currency holdings. The sixth indicator (employment in the unofficial economy in the capital of the country as % of official employment, infsec) is available only for 4 countries and for two years. The last and seventh indicator (share of sales reported for tax purposes) is available only for transition countries and Turkey.
Hence, despite all efforts we are confined to using currency as the only indicator with satisfying availability and comparable quality over countries and years (see appendix 2 for details).

Given this indicator, our definition of the SE is already determined because only those "underground" transactions can be considered that are carried out using currency.

Also included in the table of appendix 1 are a few variables with a question mark attached to them, indicating additional data needs in order to test adequately relevant theoretical models.[5] Admittedly, this is not to say that the available data are in each case fully satisfying. But an attempt was made to consider all available sources, including survey data, yielding a total of more than 20 sources.

The period chosen, 1991-2007, is the result of attempting to collect long run data while at the same time considering "soft" variables of theoretical importance which have been available in quantitative form only since relatively recently, such as preferences of economic agents, their views, for instance, on the quality of public services, on the complexity of the tax system, on corruption and so on. Also detailed data on the tax burden and labor market characteristics are available only since about the early 1990s. The frequency chosen was annual data.

However, several important variables and especially the survey data, have considerable gaps as noted. Hence, the data was averaged over the sample period with only one observation per country, which, in the best case, would be a long run average. As discussed, this interpretation is limited, however, by the availability of the data.

Since the goal of the analysis is to examine the influences on the shadow economy as detailed as possible, including potential interactions between especially the tax and social security burden and the satisfaction of taxpayers with the quantity and quality of public services, there is a general form of the equations to be estimated as follows:

$$C_i/M2_i = a_0 + a_1 \, \mathbf{\Sigma X_i} + a_2 \, Cr_i + a_3 \, \mathbf{\Sigma DSE}_i + a_4 \, V/SF_{ij} + a_5 \, (T_i * V/SF_{ij})$$
$$(+/-) \qquad (?) \qquad (?) \qquad (?) \qquad (?)$$

$$+ a_6 \, D_{EEU} + a_7 \, D_{EURO} + e_i \quad , \qquad (1)$$
$$(?) \qquad (?)$$

where $(C_i/M2_i)$ is the ratio of currency holdings to M2 and **X** is a vector of the determinants of the currency to M2 ratio as suggested by monetary theory[6]. Cr represents an indicator of serious crime and thus the "criminal" part of the shadow economy, e.g. drug trafficking, handling of stolen goods, contract killing etc., i.e. activities that cannot be integrated into the legal economy through better incentives and policies aiming at reducing the SE.
DSE is a vector of the explanatory variables of the SE shown in groups 1-6 in the table of variables, appendix 1, some of which have been used in previous studies and are well known such as the tax,

[5] Examples of important missing variables (comparable over countries) are good indicators of the degree of taxpayers' satisfaction with the quality of public services, taxpayers' risk aversion regarding tax avoidance, the probability for detection of tax fraud, the degree of punishment, social capital, "serious" and "light" crime, typical informal activity such as illegal employment in construction, educational attainment, and the quality and/or the efficacy of executive boards (management of private companies).
[6] Following the Keynesian liquidity preference we include the volume of transactions proxied by real GDP per capita and the real short term interest rate.

social security and administrative burden, economic institutions, and others are new such as the quality of administration and of the justice system. V/SF represents the variables of group 6 'values/moral' and 7 'subjective factors and other influences' in the table, appendix 1, which are to a large extent new and have not been used before in studies of the SE, such as the quality of particular public services (public schools, public infrastructure, police services), the subjective assessment of wastefulness of government spending, the subjective satisfaction with people in national office, ethical behavior of firms, etc.).

Especially regarding the tax burden, the hypothesis is that it is not the burden per se which causes shadow economic activity but rather the relation of it to the public services which taxpayers receive and/or the subjective satisfaction with public officials and/or enterprise managements and their supervisory boards, the quality of management-labor relations which may influence the SE. Such conditional hypotheses may be tested by including a corresponding interaction term as shown in equation 1, where the tax burden T is multiplied by the value/subjective factor V/SF_j. Such interaction terms have – to the best of my knowledge – not yet been used in studies on the shadow economy.

Finally, two dummies are included to account for the special situation of Eastern European transition countries and for anomalies of currency holdings during the time of the introduction of the Euro in the EMU countries. Subscript i denotes the country and subscript j the type of subjective factor. The signs in brackets shown below coefficients represent the theoretically expected sign of the respective estimated coefficient, which is unambiguous only in the cases of the monetary theory variables **X** [7].

A large number of preliminary estimations was run to test equation 1 and its robustness. Specifically, for the interaction term all possible combinations of different tax variables of group 2 with values/subjective factors of groups 6 and 7 were used and the remaining variables of groups 1-7 were included alternately as potential DSE variables. The estimated sign of the interaction term a_5 was, however, highly unstable, although in most cases highly statistically significant. Despite further efforts to reduce the specification of equation 1, using different functional forms and logs of the variables, this problem persisted. Hence, there was no alternative but to put off the attempt to estimate conditional influences on the shadow economy through inclusion of an interaction term for future research.

This preliminary work showed that in order to obtain stable and robust results the specification needs to be as parsimonious as possible. Our used base model thus is:

$$C_i/M2_i = a_0 + \mathbf{a_1 \Sigma X_i} + a_2 k_i + a_3 m_i + e_i \qquad (2)$$

where **X** represents, as before, the monetary theory variables, k represents either one of the 42 tax and social security burden variables of our second group in the table of variables (appendix 1) or one of the over 30 labor market variables of the fifth group. Indicator "m" represents all other influences, i.e. constitutional aspects (group 1), complexity of the tax system (group 2), administrative burden (group 3), quality of administration and justice system (group 4), economic institutions except labor market indicators (group 5), values and moral aspects (group 6), and subjective factors and other influences (group 7). Up to 200 variables were used for m in all. Also on account of the findings of the preliminary estimations we abstained from any transformation of the data. The regressions were run employing OLS and also by the instrumental methods two stage least squares and GMM since potential endogeniety of regressors cannot be excluded.

This approach is an unavoidable compromise between specifying strictly according to theoretical reasoning that is in many cases too demanding relative to the available data and its quality, and identification of robust influences while retaining a minimum of controls.

[7] The sign of the interest rate should be negative due to rising opportunity costs of currency holdings and the sign of real per capita GDP should be positive due to more transactions and higher wealth.

Given the large number of combinations of the two groups of k variables (the many tax and social security burden variables and labor market characteristics) with the m variables, equation 2 allows analyzing the influences on the shadow economy to a degree of detail not seen before. The resulting large output of regression results calls for an automated summarizing evaluation, which was carried out through special excel programs.[8] The results are clearly laid out in the following overview tables regarding taxes, labor market variables and other influences, where one cell shows the summarized results of up to 200 regressions for each of the three estimation methods.

An indicator was defined to be relatively significant or robust if in the majority of cases in each of the three estimation methods the same sign was obtained and if this sign was statistically significant -at least at the ten percent significance level- in 30 percent or more of the cases of at least one estimation method.[9] However, most variables that fulfilled this definition were also relatively statistically significant in the other two estimation methods. The indicators found to be relatively significant or robust were included in a ranking of their quantitative impact on the shadow economy using the average beta coefficient of all three estimation methods.

However, regarding simulations of the size of the shadow economy in this cross-section panel we use an augmented version of equation 2 where we include an indicator of serious crime so as to be able to separate the estimated "crime-based" or "criminal" shadow economy from the "non-crime based" SE and we include the two dummies for Eastern European countries and regarding the Euro introduction, respectively:

$$C_i/M2_i = a_0 + \mathbf{a_1 \Sigma X_i} + a_2\, Cr_i + \mathbf{a_3 \Sigma DSE_i} + a_6\, D_{osteu} + a_7\, D_{EURO} + e_i \qquad (3)$$

Finally, in all regressions we used the currency to M2 ratio unadjusted for estimated currency holdings abroad rather then currency per capita or currency per capita adjusted for estimated currency holdings abroad, and we used no transformed data, because the statistical significance of the results was consistently slightly higher.

4 Empirical results

4.1 Tax and social security burden

The results of our analysis of the first major group of potential causes of the shadow economy, the tax and social security burden, are shown in table 2. To save space the details of the regressions and estimation methods used are explained in a footnote of the table. For each analyzed fiscal indicator there are 2 lines in columns 2, 3, and 4, which summarize the results of 199 estimated regressions.

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[8] These programs were written by Pierre Wohlleben. Regarding our main dependent variable C/M2 about 64000 regressions were evaluated.

[9] The best accepted definition of robustness is that of Sala-i-Martin (1997), which stipulates that the 90% interval (between the 5th and 95th percentile) in the distribution of a parameter does not include zero. The distribution is derived, however, from estimating the variable of interest using all possible combinations of variables, including non-plausible ones. And only the estimated sign matters for robustness, not the significance. Our definition is somewhat more restrictive because we consider not only the estimated sign but also the significance. In addition our estimation set does not include all possible combinations of variables. Hence, it is possible for an indicator to be 'Sala-i-Martin robust' but not according to our definition, and vice versa. We have three major robustness result tables, on taxes (table 2), on labor market indicators (table 4), and concerning other factors (table 6). Roughly, if 90 percent of the regressions performed in each cell are non-zero, the respective indicator would be Sala-i-Martin robust. As can be seen in table 2, this condition is met if in 179 of the total of 199 regressions the sign is positive or negative. But many indicators, which meet this requirement, do not meet our definition because their significance is lacking. At the same time, in tables 4 and 6, a few results meet our definition of robustness but not quite the Sala-i-Martin definition. This brief discussion may corroborate our chosen definition.

In the first line the dominating estimated sign of the respective fiscal indicator is shown together with the number of regressions yielding this sign. The second number is the number of regressions where this sign is statistically significant (at least at the 10% level of significance); the third value is the number of countries included in the majority of all regressions; the last and fourth value is the beta coefficient (the estimated effect on the shadow economy of the respective fiscal variable in standard deviation units, which allows a direct comparison of the relative quantitative influence of all estimated coefficients). The beta coefficients also allow a ranking of tax variables according to their quantitative impact.

The second row gives results of statistical tests of the regressions (number of significant tests related to the specification error in OLS regressions, regarding the endogeniety of regressors and validity of instruments used in the 2SLS and GMM regressions). Those fiscal indicators found to be relatively statistically significant, robust, according to the above chosen definition were highlighted. Those tax indicators, whose estimated sign was unstable, were denoted “fragile”, and those whose sign was consistently statistically insignificant, were denoted “ins.” (insignificant). The few cases, where the estimation methods yielded ambiguous results, were italicized.

As can be seen, the association between our fiscal indicators (tax burden, social security burden, transfers and subsidies) and the shadow economy is generally positive. A few tax indicators have a robust positive sign independent of the estimation method. This refers to the **social security burden of employers**, the **total tax wedge** in broad definitions, **subsidies and transfers**, taxes **on international trade** and **government size**.

Noteworthy is that the many **tax wedge** measures are consistently pointing to higher taxation resulting in more shadow economic activity. There is no difference in the relative importance of marginal versus average tax rates.

Indirect taxes have also an estimated generally positive sign, although not significant. Given the below discussed move to a simplified and consumption based tax system this result would be welcomed. However, and admittedly, it is not clear whether the insignificance may be interpreted as evidence that indirect taxes do not matter for shadow economic activity. The reason is that a breakdown is not available of indirect tax revenues that can be evaded relatively easily and those that cannot. For instance, purchasing a home or new car or other high priced consumer goods on the black market to evade VAT/sales tax is nearly impossible in industrial countries. Since a non-negligible part of indirect tax revenues falls in this group, it is noteworthy that nevertheless the estimated sign of the association between indirect taxes and the shadow economy is mostly positive. In other words, the positive sign could become statistically significant if we had data of only those indirect tax revenues that can be relatively easily evaded, for instance, some services. Hence, there may be reasons to take the positive sign of indirect taxes serious, despite its insignificance. A move to consumption taxation would thus need to consider this, for instance, by emphasizing measures to broaden the tax base.

Table 2
Summary of Estimation results
Influence of the ***tax and social security burden*** on the shadow economy: Cross-section regression results: each cell represents 199 regressions.
Shadow Economy proxied by estimated currency holdings relative to M2 (cm2ifs).

	Currency holdings relative to M2		
	OLS	2SLS	GMM
Total tax burden:			
- Total tax revenue (% of GDP), OECD	+ 196, 59 s., 30, 0.2181 11	+ 193, 4 s., 30, 0.1526 10, 11 / 49, 49, 1	+ 172, 15 s., 30, 0.1184 1 / 1
- Total receipts general government (% of GDP), OECD	+ 191, 24 s., 30, 0.1703 5	+ 176, 7 s., 30, 0.1373 3, 3 / 46, 46, 0	+ 145, 21 s., 30, 0.1092 1 / 0
Social security burden:			
- Tax and social security burden (% of GDP), OECD	+ 197, 144 s., 28, 0.3000 9	+ 196, 11 s., 28, 0.1999 26, 39 / 43, 43, 1	+ 185, 11 s., 28, 0.1326 9 / 1
- Employees' social security contributions (average rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children), OECD	+ 197, 130 s., 28, 0.2328 2	+ 199, 20 s., 28, 0.2228 1, 0 / 28, 27, 0	+ 196, 32 s., 28, 0.1795 4 / 0
- Social security contrib. labor (% of GDP), OECD	+ 197, 7 s., 27, 0.1827 1	+ 196, 7 s., 27, 0.1850 1, 2 / 18, 18, 3	+ 187, 20 s., 27, 0.1616 0 / 3
- Social security contrib. employers (% of GDP), OECD	+ 197, 197 s., 27, 0.4634 4	+ 199, 175 s., 27, 0.5097 4, 3 / 7, 6, 2	+ 199, 187 s., 27, 0.5698 4 / 2
Tax wedges:			
- Tax wedge incl. soc.sec. (aver. rate; aver. of all income and family types; in %), OECD	+ 197, 195 s., 30, 0.3423 0	+ 198, 65 s., 30, 0.2876 2, 3 / 42, 42, 12	+ 199, 148 s., 30, 0.2875 0 / 12
- Tax wedge (average rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children, %), OECD	+ 197, 186 s., 30, 0.3189 2	+ 198, 38 s., 30, 0.2422 5, 7 / 55, 54, 11	+ 197, 92 s., 30, 0.2366 2 / 11
- Tax wedge (marginal rate; average of all income and family types; in %), OECD	+ 197, 149 s., 30, 0.2820 2	+ 191, 6 s., 30, 0.1698 8, 7 / 61, 60, 21	+ 179, 22 s., 30, 0.1348 3 / 21
- Tax wedge (marginal rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children, %), OECD	+ 197, 184 s., 30, 0.3139 2	+ 196, 28 s., 30, 0.2467 4, 5 / 58, 57, 37	+ 195, 74 s., 30, 0.2420 3 / 37
- Tax wedge (marginal rate; single person at 167% of av. earnings, no child), OECD	+ 193, 6 s., 30, 0.1401 3	+ 191, 4 s., 30, 0.1404 2, 1 / 41, 41, 3	+ 175, 14 s., 30, 0.1270 2 / 3
- Personal income tax rate (average of 6 earnings levels and 5 family types, %), OECD	fragile, 30, 0.0241 2	- 154, 6 s., 30, -0.1144 19, 17 / 31, 31, 0	- 133, 4 s., 30, -0.0523 2 / 0
- Personal income tax rate (average rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children, %), OECD	fragile, 30, 0.0008 2	- 170, 7 s., 30, -0.1571 20, 18 / 29, 29, 0	- 135, 11 s., 30, -0.0728 4 / 0
- Taxes on income, profits & capital gains of individuals (% of GDP), OECD	fragile, 29, 0.0066 3	- 192, 4 s., 29, -0.2438 57, 39 / 26, 26, 1	- 146, 14 s., 29, -0.1403 9 / 1
- Taxes on capital gains of individuals (% of GDP), OECD	fragile, 27, 0.0020 2	- 184, 4 s., 27, -0.1911 25, 28 / 7, 7, 1	- 184, 107 s., 27, -0.3105 55 / 1
Direct personal taxes:			
- Total direct taxes (% of GDP), OECD	- 168, 8 s., 28, -0.1168 6	- 188, 14 s., 28, -0.2562 12, 10 / 25, 25, 2	- 169, 18 s., 28, -0.2096 7 / 2
- Total direct personal taxes (% of GDP), OECD	fragile, 25, -0.0203 21	- 174, 3 s., 25, -0.2486 16, 15 / 35, 35, 5	- 167, 9 s., 25, -0.2403 12 / 5
- Top marginal personal tax rate, OECD et al.	*- 187, 152 s., 36, -0.2035* 179	*- 165, 6 s., 36, -0.1327* 9, 6 / 34, 33, 12	*+ 136, 6 s., 36, 0.0421* 14 / 12
- Top marginal Income tax rate and income threshold at which it applies, Fraser	+ 193, 164 s., 38, 0.2536 164	+ 185, 6 s., 38, 0.1621 3, 3 / 68, 67, 18	fragile, 38, 0.0633 4 / 18
- Top marginal income and payroll tax rate (and income threshold at which it applies), Fraser	- 140, ins., 36, -0.0124 170	- 195, 116 s., 36, -0.3022 165, 149 / 30, 30, 22	- 192, 145 s., 36, -0.3028 127 / 22
- Taxation of nominal interest income (dummy), own	- 158, 2 s., 38, -0.0419 168	- 197, 122 s., 38, -0.2982 165, 163 / 14, 14, 3	- 198, 155 s., 38, -0.3272 165 / 3
Subsidies, transfers and others			
- Subsidies (% of GDP), OECD	+ 196, 102 s., 28, 0.2360 23	+ 199, 93 s., 28, 0.3538 5, 4 / 9, 9, 1	+ 197, 147 s., 28, 0.3396 4 / 1
- Subsidies and other transfers (% of expense), WDI	+ 197, 166 s., 36, 0.2290 57	+ 199, 178 s., 36, 0.4532 151, 143 / 5, 5, 1	+ 198, 188 s., 36, 0.4120 117 / 1
- Transfers & subsidies (% of GDP), Fraser (less subs../transf. => higher indicator value)	- 193, 34 s., 38, -0.1612 163	- 199, 173 s., 38, -0.3754 111, 107 / 7, 7, 4	- 199, 191 s., 38, -0.3608 54 / 4
- Taxes less subsidies on products (% of GDP), OECD	- 193, 44 s., 34, -0.1318 44	- 159, 12 s., 34, -0.1376 9, 7 / 11, 11, 2	- 198, 20 s., 34, -0.2164 6 / 2
- Taxes on production and imports less subsidies (% of GDP), OECD	- 193, 44 s., 34, -0.1253 53	- 161, 11 s., 34, -0.1293 7, 8 / 11, 11, 2	- 197, 22 s., 34, -0.2081 9 / 2
Taxes on international trade:			
- Taxes on international trade (% of GDP), Fraser	+ 186, 167 s., 38, 0.2739 178	+ 184, 148 s., 38, 0.3850 16, 7 / 11, 11, 11	+ 183, 158 s., 38, 0.3225 7 / 11
- Customs and import duties (% of GDP), OECD	+ 194, 141 s., 30, 0.2839 8	+ 196, 180 s., 30, 0.4139 20, 9 / 8, 6, 5	+ 195, 164 s., 30, 0.4134 12 / 5
Government size, transfers and subsidies:			
- Government size, Heritage (smaller size => higher indicator vale)	- 184, 16 s., 38, -0.0921 172	- 196, 60 s., 38, -0.2305 2, 4 / 23, 23, 19	- 194, 105 s., 38, -0.2069 3 / 19
- Government size, Fraser (smaller size => higher indicator value)	- 186, 6 s., 38, -0.0968 157	- 199, 119 s., 38, -0.2872 127, 124 / 11, 11, 13	- 197, 168 s., 38, -0.2929 117 / 13
Mixed personal and corporate taxes:			
- Property taxes (% of GDP), OECD	- 197, 188 s., 30, -0.3158 1	- 199, 119 s., 30, -0.4413 5, 6 / 8, 8, 5	- 199, 185 s., 30, -0.4727 13 / 5
- Taxes on financial and capital transactions (% of GDP), OECD	- 194, 27 s., 30, -0.1568 5	- 196, 8 s., 30, -0.2147 2, 3 / 31, 31, 0	- 196, 52 s., 30, -0.1815 2 / 0
- Taxes on income, profits and capital gains (% of GDP), OECD	- 153, 4 s., 30, -0.0663 7	- 170, 4 s., 30, -0.1707 9, 7 / 34, 34, 2	- 144, 18 s., 30, -0.1150 3 / 2
Indirect taxes:			
- Indirect Taxes (% of GDP), OECD	+ 137, ins., 28, 0.0239 5	+ 136, ins., 28, 0.0271 0, 0 / 39, 39, 0	+ 147, 5 s., 28, 0.0441 0 / 0
- Taxes on goods & services, OECD	+ 165, ins., 30, 0.0454 3	+ 179, ins., 30, 0.0829 2, 2 / 46, 45, 0	+ 179, 10 s., 30, 0.0855 3 / 0
- VAT and sales taxes (% of GDP), OECD	+ 160, ins., 30, 0.0433 4	+ 179, ins., 30, 0.0830 5, 5 / 45, 45, 0	+ 173, 2 s., 30, 0.0747 0 / 0
Corporate taxes:			
- Total tax rate (% of profit), IFC	*+ 190, 21 s., 36, 0.0865* 176	*- 166, ins., 36, -0.1221* 67, 17 / 66, 66, 34	*+ 134, 17 s., 36, 0.0555* 0 / 34
- Top marginal corporate tax rate, OECD et al.	- 190, 27 s., 37, -0.1762 135	- 188, 23 s., 37, -0.2154 2, 1 / 25, 25, 6	- 170, 28 s., 37, -0.1159 4 / 6
- Total direct business taxes (% of GDP), OECD	- 194, 12 s., 25, -0.1544 32	fragile, 25, -0.0236 9, 6 / 41, 41, 2	- 149, 19 s., 25, -0.1202 2 / 2
- Corporate taxes on income, profit & capital gains (% of GDP), OECD	*- 194, 6 s., 29, -0.1620* 4	*+ 170, ins., 29, 0.1346* 60, 37 / 39, 38, 0	*fragile, 29, 0.0043* 3 / 1
Indices of effects of tax system:			
- Fiscal freedom (inc.tax rate + corp. tax rate + total tax revenue./GDP), Heritage	*+ 178, 6 s., 38, 0.1305* 177	*fragile, 38, 0.0328* 8, 8 / 50, 50, 16	*- 142, 14 s., 38, -0.0720* 3 / 16
- Extent and effect of taxation, WEF (less distortion => higher indicator)	+ 168, ins., 38, 0.0269 167	+ 171, 4 s., 38, 0.2209 18, 14 / 10, 10, 5	+ 145, 3 s., 38, 0.1011 4 / 5

Note: The sensitivity of the influence of each indicator of the tax- and social security burden was tested in 199 regressions using -one by one- all available variables of the list of indicators (Appendix 1) representing the constitutional system, the complexity of tax system, the quality of administration and of the justice system, economic institutions including tax enforcement variables but excluding labor market indicators, the educational system, the innovation potential, values and moral, and other influences and subjective factors. The sample includes 38 OECD and Eastern European countries covering the period 1991-2007. Mean values are used.
The estimated equations are of the following type: cm2ifs_m = gdprpppc_m + itstr_m + i + k, where "i" represents the respective tax variable and "k" represents the respective indicator of the the list of other economic institutions (excluding labor market indicators) and all other influences and subjective factors. The inclusion of additional controls such as an indicator of inflation and of government size, which are consistently statistically insignificant, does not significantly influence these results.
Meaning of the statements in the cells, in the order of their appearance:
First row:
Sign of estimated coefficient of the respective tax burden or fiscal indicator; number of regressions with this sign out of a total of 199 estimated regressions; number of regressions where the estimated sign is statistically significant (at least at the 10% level of significance); number of N countries (in the majority of all regressions); and beta coefficient (the estimated effect in standard deviation units to be able to directly compare the relative quantitative influence of the estimated coefficients; see also the ranking of the indicators of this table).
Second row:
OLS/WLS regressions: Number of significant Ramsey regression specification-error tests (RESET) for omitted variables.
2SLS regressions:
First value: Number of significant endogeniety tests with regard to the respective tax variable and the respective variable representing other influences using Wooldridge's robust score chi-squared test.
Second value: Same as before but using the robust regression F-test. Three values behind slash give the number of significant tests of the validity of the instruments using, respectively, a) Sargan's chi-squared test, b) Basman's chi square test, and c) Wooldridge's robust score test.
GMM regressions:
First value: Number of significant endogeniety tests using Sargan's C-statistic.
Second value: Number of significant tests of the validity of the instruments using Hansen's J-statistic shi-squared test.
Specifics of the regressions:
OLS: Regressions estimated with robust standard errors, i.e. the estimator is robust to some types of misspecification so long as the observations are independent.
2 SLS and GMM:
The respective indicator of the tax and/or social security burden was instrumented due to its potential endogeniety using the following instruments: dle_m dlf_m dlg_m dlsc_m dlso_m language_m lat_m rel1_m eth1_m. The equations were estimated using robust standard errors and small sample adjustments.

The evidence regarding **direct personal taxes** is inconsistent and thus inconclusive. Finally, there are several 'specialized' taxes with a consistently estimated negative sign, suggesting a negative association of these taxes with the SE, such as property taxes, taxation of interest income, financial and capital transactions, and corporate and business taxes. For the first three taxes the negative sign is robust but **corporate and business taxes** do not have a robust impact on the SE.

The negative sign of **taxation of interest income** and of **financial and capital transactions**, which is robust regarding the former, is unexpected because it suggests that these taxes dampen currency demand and the shadow economy. It was expected that such taxes would c.p. cause capital outflows through exporting domestic currency and thus higher demand for currency and higher shadow economic activity. However, a plausible explanation is that demand deposits and/or foreign currency

are used in realizing capital outflows, i.e. demand for domestic currency decreases. And this effect is amplified by a negative impact of capital outflows on investment and output. Hence, the decreased demand for domestic currency in response to such taxation may be associated with capital outflows and reduced output. Thus, the interpretation of the negative sign of taxation is ambiguous. Nevertheless, the impact on domestic currency demand of these taxes is negative and robust.[10]

Overall it stands out that broad measures of the tax and social security burden, **subsidies and other transfers**, and **government size** have an estimated positive, robust impact on the SE. This points to the importance of the general tax burden as a potential cause for shadow economic activity rather than particular taxes. And the results do not support the recommendation to favor indirect taxes over direct taxes as part of a strategy to reduce shadow economic activities.

The relative quantitative importance of the individual tax measures is shown in a ranking (table 3) where robust indicators were included plus selected other indicators as memorandum items.

[10] The robust sign of our proxy for interest income taxation should be an incentive to examine deeper the motives behind the recently uncovered case of massive tax evasion in Germany and France through holding savings abroad in countries with an effective bank secrecy law (Switzerland, Luxembourg, Liechtenstein etc.). A former German finance minister asserted that the motive is simply that 'people do not want to pay taxes'. This assumption may not be complete and a government should be interested to know which aspects of the tax system, other rules or causes may have contributed to such capital exports. Lawyers of those involved argued that often the motive was not merely to save taxes. Several others were provided: a) people's fear of being expropriated through government action such as inflation, which is plausible for Germany owing to two hyperinflations in the last century; b) the hiding of funds from business partners, and c) inheritances of formerly not declared savings. But the motives may also be related to specifics of the tax system: One such element is that tax payers may not accept the intertemporal distortion inherent in common income taxation since taxing savings is double taxation of formerly taxed income: comparing the life time tax burden of a person consuming all his income and a person who is saving, the latter has a higher tax burden although savings enable investment and growth. And/or taxpayers may not accept taxation of nominal interest income instead of real interest income (formerly mostly at the personal tax rate, and owing to the move to dual taxation of capital and labor income increasingly at flat rates of 20 to 30 percent). This is taxation of substance and thus slow capital expropriation if the interest return after deducting the tax is lower than the inflation rate, where inflation is also a government tax.
Hence, there are important motives for tax evasion of interest income caused by governments. The move to dual taxation and moderate capital income tax rates can thus mitigate the problem but it distorts the financial structure of firms. The via regia (best solution) would be the move to a neutral corporate and personal income tax within a simplified tax system (e.g. Boadway and Bruce, 1984; Nguyen and Rose, 2004; Rose and Petersen, 2004). There are governments who understand this: the first OECD country going in this direction by introducing recently an allowance for corporate equity was Belgium (Gerard, 2006).

Table 3
Ranking of indicators of the tax and social security burden in increasing the shadow economy 1/

Indicator	Average beta coefficient	Rank
- Social security contributions employers (% of GDP), OECD	0.5143	1
- Customs and import duties (% of GDP), OECD	0.3704	2
- Subsidies and other transfers (% of expense), WDI	0.3647	3
- Taxes on international trade (% of GDP), Fraser	0.3271	4
- Subsidies (% of GDP), OECD	0.3098	5
- Tax wedge incl. soc.sec. (aver. rate; aver. of all income and family types; in %), OECD	0.3058	6
- Transfers & subsidies (% of GDP), Fraser (less subs../transf. => higher indicator value)	-0.2991	7
- Tax wedge (marginal rate; two-earner married couple,	0.2675	8
- Tax wedge (average rate; two-earner married couple,	0.2659	9
- Government size, Fraser (smaller size => higher indicator value)	-0.2256	10
- Taxation of nominal interest income (dummy), own	-0.2224	11
- Employees' social security contributions (average rate; two-earner married couple) OECD	0.2117	12
- Tax and social security burden (% of GDP), OECD	0.2108	13
- Tax wedge (marginal rate; average of all income and family types; in %), OECD	0.1955	14
- Government size, Heritage (smaller size => higher indicator vale)	-0.1765	16
- Top marginal corporate tax rate, OECD et al.	-0.1692	18
- Total tax revenue (% of GDP), OECD	0.1630	19
Memorandum items 2/:		
- Total direct taxes (% of GDP), OECD	-0.1942	15
- Social security contributions labor (% of GDP), OECD	0.1764	17
- Total receipts general government (% of GDP), OECD	0.1389	20
- Tax wedge (marginal rate; single person at 167% of av. earnings, no child), OECD	0.1358	21
- Extent and effect of taxation, WEF (less distortion => higher indicator)	0.1163	22
- Taxes on goods & services, OECD	0.0713	23
- VAT and sales taxes (% of GDP), OECD	0.0670	24
- Indirect Taxes (% of GDP), OECD	0.0317	25

1/ Ranking based on the quantitative importance of the indicators as measured by the average beta coefficient (absolute value) of the respective OLS, 2SLS, and GMM estimations. Only indicators with consistently estimated signs and positive impact on the shadow economy were included. The beta coefficient (<1) represents the estimated average change in standard deviation units. A beta coefficient of 0.5 means that every time the independent variable changes by one standard deviation, the shadow economy variable changes by half a standard deviation, on average.

2/ Indicators not robust according to the used definition.

Source: Own estimates.

4.2 Labor market characteristics

Table 4 presents the results for the labor market indicators. Each cell summarizes the results of 200 regressions and, as before, the robust results were highlighted and the same notation was used.

Starting with the most difficult issue of labor market regulation, the three indicators of overall **labor market regulation** (LMR) all point in the same direction, namely that higher LMR increases the shadow economy or, in other words, higher labor market flexibility reduces the SE. Of the three indices, the World Bank rigidity index of Rama and Artecoma (2002) is relatively highly statistically significant and robust. This result of a positive association between LMR and the shadow economy is intuitively plausible and confirms both the older and young theories of LMR (see the summary in table 1 above, main category 5, subgroup labor market regulation).

Which of the detailed labor market characteristics (the subgroups of labor market regulation in table 1) are causing this result? The Fraser overall index has six elements: mandated cost of worker dismissal, flexibility of wage determination, hiring and firing regulations, mandated cost of hiring, minimum wage, and length of military conscription. The first two have estimated statistically significant signs in opposite direction than overall LMR. This means that the other four elements are driving the estimated positive association between overall LMR and the shadow economy, i.e. hiring and firing regulations, mandated cost of hiring, minimum wage, and length of military conscription. Hence, strictly according to the statistical results, allowing for more flexibility regarding these characteristics would tend to reduce the shadow economy.[11]

However, regarding policy conclusions, four issues need to be considered:
First, the results pertain to averages and the countries differ in the details of their labor market regulations. Deregulating one or more elements will have effects on indicators in the other groups of institutions that influence the shadow economy. For instance, if one would deregulate the hiring and firing rules, one would probably raise the short run social assistance for unemployed, i.e. the replacement rate for the initial phase of unemployment, as, for instance, Denmark has done. Since this indicator influences the shadow economy positively (see table 4), some of the SE reducing effect would be offset. In the case of Denmark, where the shadow economy is miniscule, this feedback effect is negligible. But countries differ and Denmark has special characteristics which can explain to a large extent the very low shadow economy, in particular, the relatively high quality and quantity of public services, as shown below.
Second, for countries with a relatively high degree of labor market flexibility (e.g. USA, Mexico) this finding is of little help, because even if they would raise the degree of labor market flexibility further, the resulting reduction in the shadow economy would tend to be small.
Third, the quantitative impact of labor market liberalization in reducing the SE can be very different among the countries. Hence, each country would need to analyze further in what respect and in which combination with other measures labor market liberalization may in fact contribute to reducing the SE.

Notwithstanding these qualifications, the estimated quantitative impact of labor market indicators ranks relatively high in table 5, taking the places 5, 7, 9, 13, 14, and 15. It means that LMR comes in third place following the unemployment indicators, and labor force participation rates and disregarding for a moment employee participation rights and trade union membership.

[11] Two indicators, mandated cost of hiring and minimum wage, are, however, not included in table 4 because of breaks in the series, and length of military conscription was not considered.

Table 4
Summary of Estimation results
Influence of ***labor market organization*** on the shadow economy: Cross-section regression results: each cell represents 200 regressions.
Shadow Economy proxied by estimated currency holdings relative to M2 (cm2ifs).

	Currency holdings relative to M2		
Indicator	OLS	2SLS	GMM
Overall indices:			
- Labor freedom, Heritage (more "freedom" => higher indicator value)	- 177, 1 s., 38, -0.0559 152	- 193, 28 s., 38, -0.2475 130, 78 / 13, 13, 5	- 194, 163 s., 38, -0.3475 67 / 5
- Labor market regulations, Fraser; (more flexibility => higher indicator value)	- 173, 11 s., 38, -0.0573 164	- 168, 1 s., 38, -0.0644 7, 8 / 36, 36, 15	- 163, 19 s., 38, -0.0908 5 / 15
- Labor market rigidity index, Rama, Artecona (2002)	+ 199, 111 s., 29, 0.2325 147	+ 195, 61 s., 29, 0.3113 1, 1 / 156, 156, 41	+ 178, 59 s., 29, 0.2053 2 / 41
Unemployment:			
- Unemployment rate , OECD	+ 199, 141 s., 38, 0.2454 151	+ 178, 63 s., 38, 0.3649 9, 7 / 15, 15, 8	+ 175, 57 s., 38, 0.2344 3 / 8
- Long term unemployment (% of labor force), OECD	*+ 200, 2 s., 30, 0.1861* 24	*fragile, 30, 0.0076* 7, 5 / 37, 37, 0	*- 147, 1 s., 30, -0.0823* 22 / 0
- Discouraged workers (% of labor force) , OECD	+ 195, 4 s., 17, 0.1944 19	fragile, 17, 0.0000 19, 0 / 7, 10, 1	fragile, 17, 0.1077 5 / 0
- male	+ 196, 15 s., 16, 0.2836 6	fragile, 16, 0.0304 18, 0 / 22, 36, 0	+ 173, 64 s., 16, 0.4665 2 / 2
- female	+ 197, 16 s., 17, 0.2756 7	fragile, 17, 0.2525 20, 0 / 2, 7, 3	+ 179, 81 s., 17, 0.3738 18 / 4
- Non-employment rate: (= 15 - 65 years old - employment)/ 15 – 65 y.o.), OECD	+ 200, 106 s., 30, 0.2572 23	fragile, 30, 0.0226 46, 42 / 42, 43, 4	fragile, 30, -0.0095 28 / 4
- Vulnerable employment 1/ (% of total employment) , WDI	- 200, 177 s., 28, -0.4312 46	- 200, 174 s., 28, -0.5109 19, 6 / 4, 4, 33	- 196, 178 s., 28, -0.4466 3 / 32
Participation rates:			
- Labor force participation rate, OECD	+ 200, 200 s., 30, 0.2817 9	+ 200, 4 s., 30, 0.3120 0, 0 / 30, 30, 3	+ 200, 58 s., 30, 0.2607 0 / 3
- Female participation rate, Rama, Artecona (2002)	+ 184, 26 s., 36, 0.1270 138	+ 196, 36 s., 36, 0.2313 64, 102 / 13, 12, 11	+ 180, 26 s., 36, 0.1170 1 / 11
- Male participation rate, Rama, Artecona (2002)	fragile, 36, -0.0003 160	- 189, 12 s., 36, -0.1579 42, 35 / 28, 28, 2	- 199, 119 s., 36, -0.2218 112 / 2
Hiring and firing:			
- Hiring and firing practices, WEF; (more determined by employer => higher value)	- 195, 1 s., 38, -0.0767 168	fragile, 38, 0.0175 6, 5 / 42, 40, 9	- 167, 6 s., 38, -0.1018 1 / 9
- Mandated cost of worker dismissal, Fraser; (lower cost => higher value)	+ 199, 59 s., 36, 0.2225 175	+ 199, 103 s., 36, 0.3099 8, 5 / 41, 41, 6	+ 190, 151 s., 36, 0.2773 1 / 6
Wage determination:			
- Flexibility of wage determination, WEF (more flexibility => higher indicator value)	+ 164, ins., 38, 0.0360 164	+ 188, 6 s., 38, 0.1520 27, 27 / 18, 17, 7	+ 162, 18 s., 38, 0.1058 5 / 7
Remuneration:			
- Degree of pay related to worker productivity, WEF	+ 171, ins., 38, 0.0629 160	+ 190, 5 s., 38, 0.1373 25, 24 / 18, 17, 26	fragile, 38, 0.0359 1 / 26
Participation rights:			
- Employee's participation rights, ETUI	+ 187, 22 s., 38, 0.1140 149	+ 199, 141 s., 38, 0.3016 107, 44 / 11, 11, 3	+ 199, 181 s., 38, 0.3235 17 / 3
Unionization:			
- Trade union members (% of employees), OECD	+ 160, 1 s., 30, 0.0407 3	+ 172, ins., 30, 0.0727 0, 0 / 36, 36, 1	+ 171, 20 s., 30, 0.0796 1 / 1
- Total trade union membership, Rama, Artecona (2002)	+ 199, 29 s., 32, 0.1807 20	+ 195, 27 s., 32, 0.1816 0, 3 / 62, 60, 43	+ 189, 34 s., 32, 0.1414 5 / 42
Replacement rates:			
- Replacement Rate for long term unemploym. (average net rate in %), OECD	*- 160, 11 s., 29, -0.0747* 6	*+ 176, 6 s., 29, 0.1617* 134, 126 / 26, 26, 1	*+ 142, 14 s., 29, 0.1269* 48 / 1
- Replacement Rate for initial phase of unempl. (average net rate in %), OECD	+ 169, ins., 29, 0.0493 11	+ 188, 9 s., 29, 0.1841 9, 7 / 24, 24, 0	+ 192, 75 s., 29, 0.2291 3 / 0
Labor market programs:			
- Active labor market program expenditures (% of GDP), OECD	+ 160, 17 s., 28, 0.0777 11	fragile, 28, -0.0529 27, 31 / 36, 35, 5	fragile, 28, 0.0019 3 / 5
- Education/training expenditures for unemployed (% of GDP), OECD	+ 183, 39 s., 28, 0.1359 10	fragile, 28, 0.0007 39, 27 / 40, 40, 0	+ 150, 29 s., 28, 0.0682 20 / 0
Strikes and lock-outs:			
- Number per year, Rama, Artecona (2002)	*+ 156, ins., 29, 0.0194* 112	*- 197, 6 s., 29, -0.2688* 60, 34 / 158, 156, 85	*- 196, 28 s., 29, -0.2893* 21 / 85
- Workdays lost, Rama, Artecona (2002)	+ 187, 104 s., 29, 0.1541 126	+ 146, 9 s., 29, 0.1311 12, 11 / 186, 186, 84	+ 142, 12 s., 29, 0.0847 6 / 84

1/ Vulnerable employment is unpaid family workers and own-account workers as a percentage of employment.

Note: The sensitivity of the influence of each labor market variable was tested in 200 regressions using -one by one- all available variables of our list of indicators (Appendix 1) representing the constitutional system, the complexity of tax system, the quality of administration and of the justice system, economic institutions including tax enforcement variables but excluding labor market indicators, the educational system, the innovation potential, values and moral, and other influences and subjective factors. The sample includes 38 OECD and Eastern European countries covering the period 1991-2007. Mean values are used. In case of indicators with similar meaning published by different institutions and where one is based to some extent on the other, an attempt was made to use only the original source variable. The estimated equations are of the following type: cm2ifs_m = gdprpppc_m + itstr_m + i + k, where i represents the respective labor market indicator and k represents the respective indicator of the list of other economic institutions (excluding labor market indicators) and all other influences and subjective factors. The inclusion of additional controls such as an indicator of inflation and of government size, which are consistently statistically insignificant, does not significantly influence these results. Relatively highly significant results are shaded.

Meaning of the statements in the cells, in the order of their appearance:

First row:

Sign of estimated coefficient of the respective labor market indicator; number of regressions with this sign out of a total of 200 estimated regressions; number of regressions where the estimated sign is statistically significant (at least at the 10% level of significance); number of N countries (in the majority of all regressions); and beta coefficient (the estimated effect in standard deviation units to be able to directly compare the relative quantitative influence of the estimated coefficients; see also the ranking of the indicators of this table).

Second row:

OLS regressions: Number of significant Ramsey regression specification-error tests (RESET) for omitted variables.

2SLS regressions:

First value: Number of significant endogeniety tests with regard to the respective labor market variable and the respective variable representing other influences using Wooldridge's robust score chi-squared test. Second value: Same as before but using the robust regression F-test. Three values behind slash give the number of significant tests of the validity of the instruments using, respectively, a) Sargan's chi-squared test, b) Basman's chi square test, and c) Wooldridge's robust score test.

GMM regressions:

First value: Number of significant endogeniety tests using Sargan's C-statistic. Second value behind slash: Number of significant tests of the validity of the instruments using Hansen's J-statistic shi-squared test.

Specifics of the regressions:

OLS: Regressions estimated with robust standard errors, i.e. the estimator is robust to some types of misspecification so long as the observations are independent.

2 SLS and GMM:

The labor market indicator i was instrumented due to its potential endogeniety using the following instruments: legal origin of country, (i.e. either british, french, german, scandinavian, or socialist), language, latitude, religious and ethnic fractionalization. The equations were estimated using robust standard errors and small sample adjustments.

As can be seen in table 4, the **unemployment rate** (OECD data) has a relatively highly statistically significant and robust estimated positive sign. Therefore it is top ranking in table 5 among the labor market indicators. In fact, this estimated sign may be considered a test of reliability of the chosen dependent variable because if unemployment would not have been found to be positively and significantly related to the shadow economy, there should be something wrong with the chosen indicator of the SE.
Other measures of unemployment and the indicator '**discouraged workers**' also have mostly a positive sign and apparently the gender of discouraged workers does not matter. Only in some of the instrumental variables regressions the signs are fragile. Since it is well known that unemployment statistics are manipulated to reduce the number of officially recognized unemployed, we also used the **non-employment rate** (the working age people minus employment divided by the former). However, it has a statistically highly significant positive impact on the SE only in the OLS regressions.

A further indicator related to unemployment measures is '**vulnerable employment**', defined as unpaid family workers and own-account workers as a percentage of employment. It is the first ranking labor market indicator in table 5. Its estimated sign is consistently negative and highly significant, which suggests that own-account working and shadow economic activity are close substitutes. In other words, people who work as own account workers or unpaid family workers either came formerly from the shadow economy or they move relatively easily to the shadow economy. This underlines the known and plausible policy implication, namely that facilitation of officially recognized own-account working and incentives to pay family workers would dampen the shadow economy.

Surprisingly, the association between the **labor participation** rate and the shadow economy is robustly positive. It ranks on the third place (table 5). This positive association has an interesting background: As shown in table 4, the male and the female participation rates of Rama and Artecona (2002) have estimated opposite signs, namely positive for females and negative for males. This would suggest that the estimated positive impact of the overall participation rate comes from female participation, which would be consistent with the empirical evidence of females facing disadvantages at the official labor market and therefore may turn more easily to unofficial activity. The policy conclusion would be that policies aiming at equal opportunities for woman or affirmative action for woman regarding their hiring would reduce the SE.

Turning to the indicators **employee participation rights** and trade union membership, great care must be taken not to misinterpret the estimated positive signs: As seen in the theoretical overview, it can be argued that labor participation rights slow down management decisions and result in higher costs, less competitiveness of enterprises, and both higher unemployment and shadow economic activity than otherwise. However, the overwhelming part of the empirical literature on this issue, namely usually individual country studies, does not find significant negative but rather positive effects of labor participation rights on economic performance, for instance, on productivity (e.g. Fitzroy and Kraft, 2005). The index of employee participation rights used here is the first attempt to condense the available information on these rights in the 38 countries of this study (see the publications of the European Trade Union Institute, ETUI, in Brussels), in an index on a scale with merely 3 units. This is the first time a cross section index has been constructed. Labor participation rights differ highly among the countries, are a very complex issue due to the many facets involved, and even when there are no formal rights, the degree of effective labor participation may be higher than in countries with such rights given that they are difficult to be enforced and can be undermined. Hence, further work on this index is required to increase its reliability.

The theoretical expectation regarding the **trade union membership** is also ambiguous because, on the one hand, it could contribute to better labor-management relations, higher productivity and even in wage demands that consider labor unit costs and thereby contributing to a high employment level and less shadow economy. On the other hand, it could contribute to wage demands that result in rising unit labor costs and unemployment, and thus a higher SE, although we find this theory at adds with the experience of several countries with a relatively high degree of trade union membership who did not have such adverse experiences. The estimated consistently positive signs of the two indicators of

Table 5
Ranking of indicators of labor market organization in influencing the shadow economy 1/

Indicator	Average beta coefficient	Rank
- Vulnerable employment 2/ (% of total employment) , WDI	-0.4629	1
- Discouraged workers (% of labor force) , OECD, female	0.3006	2
- Labor force participation rate, OECD	0.2848	3
- Unemployment rate, OECD	0.2816	4
- Mandated cost of worker dismissal, Fraser; (lower cost => higher value)	0.2699	5
- Discouraged workers (% of labor force), OECD, male	0.2602	6
- Labor market rigidity index, Rama, Artecona (2002)	0.2497	7
- Employee's participation rights, ETUI	0.2464	8
- Labor freedom, Heritage (more "freedom" => higher indicator value)	-0.2170	9
- Replacement rate for initial phase of unemploym. (average net rate in %), OECD	0.1542	11
- Workdays lost, Rama, Artecona (2002)	0.1233	12
Memorandum items 3/:		
- Total trade union membership, Rama, Artecona (2002)	0.1679	10
- Flexibility of wage determination, WEF (more flexibility => higher indicator value)	0.0979	13
- Degree of pay related to worker productivity, WEF	0.0787	14
- Labor market regulations, Fraser; (more flexibility => higher indicator value)	-0.0708	15
- Education/training expenditures for unemployed (% of GDP), OECD	0.0683	16
- Trade union members (% of employees), OECD	0.0643	17

1/ Ranking based on the quantitative importance of the indicators as measured by the average beta coefficient (absolute value) of the respective OLS, 2SLS, and GMM estimations. Only indicators with consistently estimated signs and positive impact on the shadow economy were included. The beta coefficient (<1) represents the estimated average change in standard deviation units.
2/Vulnerable employment is unpaid family workers and own-account workers as a percentage of employment. No data available for important countries, e.g. Canada, all scandinavian countries, UK, USA.
3/ Indicators not robust according to the used definition.
Source: Own estimates.

trade union membership are therefore unexpected, However, they are mostly statistically insignificant (table 4), so that we cannot corroborate either hypothesis.

The three remaining labor market indicators are **replacement rates for the unemployed**, labor market programs and labor conflicts. It is often hypothesized that the effect of replacement rates on the SE is positive due to some misuse of social assistance. Table 4 shows that, indeed, there is some evidence for this, particularly regarding short-term unemployment. One explanation could be that despite higher incentives to work in the SE during long-term unemployment owing to lower unemployment benefits, the incentive is there to use relatively high short-term unemployment benefits as a supplement to unofficial income and then turn back to official employment when short-term unemployment benefits end.

The result for **labor market programs** is unexpected because the estimated sign is mostly positive, albeit not robust. If labor market programs would fulfill their goal, the sign should be significantly negative. Hence, this evidence should be taken as a call to improve these programs.

The last indicator concerns **labor conflicts** and shows that workdays lost are clearly contributing to the SE. Thus, policies aiming at mitigating such conflicts would reduce the SE.

Comparing the quantitative impact of the labor market indicators (table 5) with that of the tax indicators (table 3), shows that the latter have a somewhat higher average impact. The impact is,

however, even stronger regarding some of the following other institutional characteristics and subjective factors, most notably corruption, and perhaps unsurprisingly satisfaction with life and feeling of happiness!

4.3 Other institutional characteristics and subjective factors

Most noteworthy about the analysis of the remaining potential influences on the SE[12] (167 variables in all, see table 6) is that the results are entirely plausible since almost all of them have the expected sign and the few unexpected signs can well be explained.

Moreover, the estimated quantitative impact of several of these additional influences exceeds that of the standard causes of the SE, which are the tax-, social security-, and regulatory burden. This is shown by table 7, which provides a ranking of the relatively significant and robust results according to the definition chosen in this paper.

As can be seen the top ranking influences shown in the table have considerably higher average beta coefficients compared to those of the tax burden and labor market characteristics shown in tables 3 and 5, respectively. This supports the hypothesis that shadow economic activity is conditional on many factors other than the commonly accepted standard causes. This is crucial because these other factors may well have a negative impact on the shadow economy. So if former empirical studies on the SE argued that the consideration of only one or few potential causes of the SE (like taxes and regulatory burden) means that the estimated size of the SE is most likely an underestimate, this may not be convincing because they leave out potentially important dampening factors so that the actual shadow economy may also well be lower than estimated.

With only one exception the signs of the robust indicators listed in tables 6 and 7 are plausible and consistent with theory.[13] We summarize the results by going through the subgroups to which the individual indices belong. The reader is asked to browse through tables 6 and 7 to find influences of her/his special interest and the respective estimated impact.

A possible objection to these findings is that given the relatively large number of indices used in this study it can be an artifact if one finds several of them to have the 'correct' i.e. expected estimated sign which is relatively significant. However, table 6 shows that with few exceptions the estimated signs within the individual subgroups are consistent and within each subgroup several (in the case of corruption all) of the indicators are relatively significant and not merely a small percentage of them. Six subgroups did not have robust results and thus were not included in table 7, namely the innovation potential, religion, globalization, inequality of income, gender, and population structure.

Noteworthy, in addition to the estimated quantitative impact, is the order of the ranking in table 7. Specifically, the administrative burden, commonly assumed to be of high importance, ranks substantially behind other factors. Previously, these other factors may have been thought to be of little or no importance for the shadow economy in wealthy countries, such as corruption, quality of the justice system, feeling of happiness, quality of administration, and the perception of state and enterprise representatives by economic agents. But these factors rank not only before taxes and the administrative burden but also considerably above other important influences such as tax

[12] These are groups 4, 5 except labor market characteristics, 6, and 7 in appendix 1.

[13] The exception is the second last indicator in table 7, the desire of people for higher income equality. This sign is discussed below.

Table 6
Summary of Estimation results
Influence of selected ***institutional aspects, other influences and subjective factors*** on the shadow economy: Cross-section regression results: each cell represents 69 regressions as explained below to identify significant influences. The shadow economy is proxied by currency holdings relative to M2 (cm2ifs).

	Currency holdings relative to M2		
	OLS	2SLS	GMM
Constitutional system:			
- Democratic system , Polity (more democratic => higher indicator value)	fragile, 28, 0.0076 24	fragile, 28, -0.0151 8, 8 / 32, 31, 6	- 52, 8 s., 28, -0.1065 5 / 6
- Combined Polity Score, Polity	+ 43, 1 s., 28, 0.0204 25	fragile, 28, -0.0040 7, 8 / 35, 33, 6	- 49, 7 s., 28, -0.0966 5 / 6
- Regime Durability, Polity	- 41, 2 s., 29, -0.2172 18	- 38, 3 s., 29, -0.1798 5, 5 / 16, 16, 0	- 39, 21 s., 29, -0.2945 2 / 0
- Executive Constraints, Polity (constraints for top political level => higher indicator value)	fragile, 28, 0.0118 25	fragile, 28, 0.0021 8, 7 / 33, 33, 6	- 42, 5 s., 28, -0.0415 5 / 6
- Regulation of Participation, Polity	fragile, 28, 0.0505 30	fragile, 17, -0.0116 7, 7 / 20, 20, 3	- 28, 5 s., 17, -0.1078 4 / 3
- Having Democratic system in Country is good, WVS (higher affirmation => higher value)	+ 57, 7 s., 30, 0.1006 25	+ 57, 7 s., 30, 0.1122 9, 6 / 3, 3, 5	+ 61, 20 s., 30, 0.1537 5 / 5
- Rule of Law, WBGI	- 66, 28 s., 30, -0.2848 25	- 65, 22 s., 30, -0.2944 13, 10 / 4, 4, 0	- 67, 37 s., 30, -0.3226 10 / 0
- Political Stability & Absence of Violence, WBGI	fragile, 30, -0.0467 29	fragile, 30, -0.0523 7, 4 / 23, 23, 6	- 44, 21 s., 30, -0.0939 6 / 6
Elements of direct democracy:			
- Political action signing a petition (have done), (higher affirmation => higher indicator value)	- 66, 10 s., 30, -0.2092 22	- 64, 5 s., 30, -0.2023 10, 10 / 4, 4, 2	- 68, 22 s., 30, -0.2327 5 / 2
- Country is run for all people, WVS	fragile, 18, -0.0633 32	fragile, 18, -0.0594 10, 9 / 19, 18, 4	fragile, 18, 0.0451 4 / 1
- Democratic accountability, ICRG	- 69, 38 s., 30, -0.2716 22	- 69, 35 s., 30, -0.2843 12, 8 / 3, 3, 1	- 69, 58 s., 30, -0.3153 7 / 1
- Voice and Accountability, WBGI	fragile, 30, -0.0359 28	fragile, 30, -0.0505 9, 8 / 5, 5, 4	- 49, 13 s., 30, -0.1054 10 / 4
Complexity of tax system:			
- Tax payments (number), IFC	fragile, 29, 0.0666 31	fragile, 29, 0.0609 12, 7 / 18, 18, 6	+ 44, 7 s., 29, 0.1008 4 / 6
- Tax payments (number), WDI	+ 46, 32 s., 29, 0.1789 28	+ 47, 32 s., 29, 0.1790 11, 5 / 12, 13, 9	+ 47, 33 s., 29, 0.1781 3 / 9
- Paying taxes (time hours), IFC	+ 46, 6 s., 29, 0.1411 31	+ 48, 5 s., 29, 0.1379 5, 4 / 13, 13, 4	+ 62, 22 s., 29, 0.1900 2 / 4
- Cost of tax compliance for business, Fraser (lower cost => higher indicator value)	- 42, 5 s., 28, -0.0906 25	- 47, 3 s., 28, -0.0963 3, 3 / 17, 17, 7	- 52, 14 s., 28, -0.1073 3 / 7
- Compliance cost of importing and exporting, Fraser (lower cost => higher indicator value)	- 45, 14 s., 30, -0.1423 30	- 45, 12 s., 30, -0.1424 12, 9 / 5, 5, 1	- 46, 31 s., 30, -0.1776 7 / 1
Administrative burden			
- Business regulations, Fraser (less bureaucratic cost => higher indicator value)	- 66, 13 s., 30, -0.1937 23	- 62, 12 s., 30, -0.2003 14, 9 / 4, 4, 0	- 66, 34 s., 30, -0.2900 12 / 0
- Administrative requirements, Fraser (less bureaucratic cost => higher indicator value)	- 60, 24 s., 30, -0.1241 26	- 58, 19 s., 30, -0.1377 15, 10 / 4, 4, 0	- 67, 25 s., 30, -0.1830 11 / 0
- Burden of government regulation, WEF (less burdensome => higher indicator value)	- 62, 29 s., 30, -0.1596 26	- 61, 29 s., 30, -0.1673 11, 9 / 4, 4, 0	- 66, 28 s., 30, -0.1936 8 / 0
- Regulatory quality, WBGI (higher quality => higher indicator value)	- 44, 17 s., 30, -0.1433 28	- 45, 17 s., 30, -0.1579 13, 8 / 6, 6, 1	- 50, 36 s., 30, -0.2079 8 / 1
- Bureaucratic quality, ICRG (higher quality => higher indicator value)	- 68, 6 s., 30, -0.2877 28	- 67, 8 s., 30, -0.2887 7, 8 / 4, 4, 3	- 69, 47 s., 30, -0.4165 5 / 3
- Quality of Regulatory standards, WEF (more stringent => higher indicator value)	- 67, 1 s., 30, -0.1309 29	- 63, 3 s., 30, -0.1264 9, 7 / 16, 16, 5	- 66, 14 s., 30, -0.1983 6 / 5
- Bureaucracy costs, Fraser (less bureaucratic cost => higher indicator value)	- 43, ins., 30, -0.0501 23	- 44, ins., 30, -0.0358 13, 14 / 10, 10, 4	- 52, 5 s., 30, -0.0651 8 / 4
- Starting a business, Fraser (less burdensome => higher indicator value)	- 68, 6 s., 30, -0.1912 22	- 63, 7 s., 30, -0.1930 11, 9 / 5, 5, 0	- 68, 41 s., 30, -0.3173 8 / 0
- Extra payments/bribes, Fraser (less bribes => higher indicator value)	- 66, 29 s., 30, -0.2355 22	- 65, 25 s., 30, -0.2491 11, 8 / 2, 2, 0	- 67, 49 s., 30, -0.3005 7 / 0
- Business Freedom, Heritage (more "freedom" => higher indicator value)	- 69, 43 s., 30, -0.3243 22	- 66, 43 s., 30, -0.3232 18, 13 / 21, 21, 0	- 68, 49 s., 30, -0.3884 6 / 0
- No. procedures start business, WEF (higher bureaucracy => higher indicator value)	+ 45, 11 s., 30, 0.1345 23	+ 46, 10 s., 30, 0.1339 10, 9 / 3, 3, 5	+ 59, 36 s., 30, 0.2115 5 / 5
- Time req. to start a business, WEF (higher bureaucracy => higher indicator value)	+ 67, 37 s., 29, 0.2098 23	+ 64, 31 s., 29, 0.2018 6, 5 / 11, 11, 2	+ 68, 40 s., 29, 0.2099 3 / 2
- No. of procedures to resolve a dispute	+ 56, ins., 26, 0.0572 30	+ 55, ins., 26, 0.0623 8, 5 / 44, 44, 5	+ 48, 11 s., 26, 0.0528 7 / 5
- Extent of bureaucratic red tape, WEF (% of worktime increases => higher indicator value)	- 43, ins., 30, -0.0316 24	- 42, ins., 30, -0.0433 12, 13 / 9, 9, 3	- 43, 1 s., 30, -0.0333 7 / 3
Trade related:			
- Hidden trade barriers, WEF (less barriers => higher indicator value)	- 66, 4 s., 30, -0.1836 25	- 69, 5 s., 30, -0.1977 7, 8 / 3, 3, 3	- 68, 23 s., 30, -0.2335 9 / 3
- Non-tariff trade barriers, Fraser (less barriers => higher indicator value)	- 66, 9 s., 30, -0.1684 24	- 68, 7 s., 30, -0.1805 10, 8 / 4, 5, 2	- 67, 23 s., 30, -0.2010 7 / 2
- Regulatory Trade Barriers, Fraser (less barriers => higher indicator value)	- 63, 14 s., 30, -0.1735 26	- 66, 10 s., 30, -0.1861 8, 8 / 4, 4, 2	- 64, 22 s., 30, -0.2092 8 / 2
- Trade freedom, Heritage (more "freedom" => higher indicator value)	- 43, 31 s., 30, -0.1948 26	- 44, 28 s., 30, -0.1837 9, 8 / 5, 5, 4	- 48, 33 s., 30, -0.2623 8 / 4
Quality of administration:			
- Government Effectiveness, WBGI	- 69, 27 s., 30, -0.3126 23	- 68, 22 s., 30, -0.3327 10, 7 / 3, 3, 1	- 68, 46 s., 30, -0.3533 9 / 1
- Control of Corruption, WBGI	- 69, 33 s., 30, -0.3418 22	- 69, 35 s., 30, -0.3601 10, 6 / 3, 3, 0	- 69, 48 s., 30, -0.3605 10 / 0
- Efficiency of legal framework, WEF (more efficient => higher indicator value)	- 69, 18 s., 30, -0.2701 22	- 69, 14 s., 30, -0.2842 13, 9 / 1, 1, 1	- 68, 42 s., 30, -0.3159 12 / 1
- Irregular payments in public utilities, WEF (less irregularity => higher indicator value)	- 46, 31 s., 30, -0.2138 29	- 47, 24 s., 30, -0.2099 11, 8 / 4, 4, 0	- 54, 40 s., 30, -0.2743 8 / 0
- Irregular payments in tax collection, WEF (less irreg. => higher indicator value)	- 67, 3 s., 30, -0.1702 24	- 64, 4 s., 30, -0.1714 10, 8 / 4, 4, 0	- 63, 22 s., 30, -0.2166 7 / 0
- Irreg. paym. in public contracts, WEF (less irreg. => higher indicator value)	- 67, 35 s., 30, -0.3039 25	- 67, 30 s., 30, -0.3077 11, 7 / 3, 3, 1	- 68, 53 s., 30, -0.3449 7 / 1

Quality of justice system:			
- Irreg. paym. in judicial decisions, WEF (less irreg. => higher indicator value)	- 69, 27 s., 30, -0.3160	- 69, 28 s., 30, -0.3188	- 69, 51 s., 30, -0.3560
	27	12, 9 / 3, 3, 0	6 / 0
- Judicial independence, WEF (higher independence => higher indicator value)	- 69, 39 s., 30, -0.3784	- 69, 37 s., 30, -0.3871	- 69, 60 s., 30, -0.3767
	26	14, 9 / 1, 1, 0	15 / 0
- Integrity of the legal system, Fraser (higher integrity => higher indicator value)	- 69, 43 s., 30, -0.3397	- 69, 38 s., 30, -0.3512	- 69, 56 s., 30, -0.3603
	25	12, 9 / 2, 2, 1	7 / 1
- Impartial courts, Fraser (higher impartiality => higher indicator value)	- 69, 17 s., 30, -0.2651	- 69, 17 s., 30, -0.2811	- 68, 42 s., 30, -0.3094
	22	13, 10 / 1, 1, 0	9 / 0
- Bribes for influencing laws, policies, regulations, decrees, WEF (less bribes =>higher value)	- 66, 10 s., 30, -0.1969	- 65, 6 s., 30, -0.1992	- 65, 29 s., 30, -0.2383
	24	11, 8 / 5, 5, 1	5 / 1
- Confidence in justice system, WVS	- 62, 23 s., 30, -0.1399	- 59, 20 s., 30, -0.1341	- 52, 20 s., 30, -0.1145
	25	12, 10 / 10, 10, 3	7 / 3
Economic Institutions			
- Protection of property rights, Fraser	- 69, 9 s., 30, -0.2674	- 69, 7 s., 30, -0.2757	- 69, 41 s., 30, -0.3222
	23	9, 7 / 3, 3, 0	9 / 0
- Protection of property rights, Heritage	- 69, 31 s., 30, -0.3634	- 69, 32 s., 30, -0.3778	- 69, 49 s., 30, -0.3886
	20	12, 10 / 1, 1, 0	5 / 0
- Protection of property rights, WEF	- 65, 13 s., 30, -0.2277	- 59, 11 s., 30, -0.2302	- 65, 38 s., 30, -0.3019
	23	11, 7 / 6, 6, 0	7 / 0
- Intellectual property rights	- 69, 10 s., 30, -0.2905	- 69, 10 s., 30, -0.2994	- 69, 37 s., 30, -0.3076
	22	5, 5 / 3, 3, 0	5 / 0
- Regulation of entry (=contract law, legal formalism), IFC (higher cost => higher value)	+ 45, 41 s., 28, 0.2203	+ 45, 40 s., 28, 0.2367	+ 62, 33 s., 28, 0.2565
	26	9, 6 / 21, 21, 5	4 / 5
- Number of legal procedures to collect an unpaid check (contract law, legal formalism), IFC (higher cost => higher value)	+ 44, 31 s., 28, 0.1265	+ 47, 31 s., 28, 0.1361	+ 66, 42 s., 28, 0.2222
	39	5, 2 / 39, 39, 3	3 / 3
- Enforcing contracts (days), IFC (higher effort => higher value)	fragile, 27, -0.0105	fragile, 27, -0.0104	fragile, 27, 0.0518
	24	9, 9 / 44, 43, 3	2 / 3
- Legal enforcement contracts, Fraser (lower cost => higher value)	- 43, 5 s., 28, -0.0645	- 42, 4 s., 28, -0.0607	fragile, 28, -0.1366
	27	8, 4 / 37, 38, 7	3 / 7
- Auditing & Reporting Standards, WEF ("stronger" => higher indicator value)	- 67, 37 s., 30, -0.2709	- 63, 31 s., 30, -0.2786	- 68, 43 s., 30, -0.3245
	24	14, 12 / 2, 2, 0	5 / 0
- Investor protection index, IFC (better protection => higher indicator value)	- 69, 66 s., 29, -0.2965	- 69, 62 s., 29, -0.3018	- 69, 68 s., 29, -0.3240
	23	11, 8 / 3, 3, 0	1 / 0
- Disclosure index	- 69, 28 s., 29, -0.2074	- 69, 30 s., 29, -0.2162	- 68, 44 s., 29, -0.2140
	25	10, 8 / 12, 12, 5	2 / 5
- Director Liability index	- 69, 66 s., 29, -0.2786	- 69, 60 s., 29, -0.2744	- 69, 62 s., 29, -0.2748
	19	3, 2 / 2, 2, 3	3 / 3
- Intensity of local competition, WEF (higher intensity => higher indicator value)	- 53, 1 s., 30, -0.0735	- 52, ins., 30, -0.0728	- 48, 16 s., 30, -0.0913
	25	8, 9 / 12, 12, 4	6 / 4
- Investment Freedom, Heritage (more "freedom" => higher indicator value)	+ 52, 3 s., 30, 0.0724	+ 53, 3 s., 30, 0.0715	+ 43, 16 s., 30, 0.0518
	25	10, 6 / 5, 5, 3	8 / 3
- Monetary Freedom, Heritage (more "freedom" => higher indicator value)	- 44, 11 s., 30, -0.1259	- 47, 10 s., 30, -0.1227	- 49, 10 s., 30, -0.1442
	28	12, 11 / 7, 7, 2	5 / 2
- Financial Freedom, Heritage (more "freedom" => higher indicator value)	- 45, ins., 30, -0.0458	- 48, 1 s., 30, -0.0436	- 48, 11 s., 30, -0.0652
	25	10, 10 / 5, 5, 4	6 / 4
Tax enforcement:			
a) Probability of tax fraud detection			
- Tax administration expenditure (in % of GDP), OECD	+ 47, ins., 21, 0.0375	+ 44, ins., 21, 0.0420	- 54, 10 s., 21, -0.0826
	4	10, 10 / 9, 12, 0	3 / 0
- Tax administration staff per taxpayer, OECD	- 61, 30 s., 29, -0.1217	fragile, 29, 0.0000	- 60, 35 s., 29, -0.1224
	24	9, 5 / 13, 13, 2	3 / 0
- Tax auditors per taxpayer, in o/oo, OECD	- 68, 23 s., 27, -0.1562	fragile, 27, 0.0000	- 67, 39 s., 27, -0.2146
	4	4, 4 / 32, 31, 0	0 / 0
- Verification activities per taxpayer, OECD	+ 69, 25 s., 27, 0.1834	+ 68, 13 s., 27, 0.1787	+ 65, 32 s., 27, 0.1967
	8	15, 13 / 12, 13, 9	8 / 9
- Number of citizens per tax administration staff, OECD	+ 62, 12 s., 30, 0.0834	+ 57, 12 s., 30, 0.0952	+ 61, 25 s., 30, 0.1071
	26	9, 7 / 4, 4, 6	6 / 6
- Police per 100th. population, Eurostat	+ 64, 4 s., 28, 0.1373	+ 64, 6 s., 28, 0.1471	+ 68, 19 s., 28, 0.1976
	32	11, 12 / 11, 11, 4	5 / 4
b) Punishment			
- Number prisoners (per 100 th. population), Eurostat	+ 69, 57 s., 28, 0.2532	+ 69, 57 s., 28, 0.2602	+ 69, 54 s., 28, 0.2563
	28	14, 13 / 29, 29, 7	10 / 7
Educational system			
- Public spending on education, total (% of GDP), WDI	+ 48, ins., 30, 0.0360	fragile, 30, 0.0664	fragile, 30, 0.0438
	29	16, 12 / 7, 7, 7	10 / 7
- School enrollment, secondary (% gross), WDI	- 67, 12 s., 30, -0.1396	- 69, 12 s., 30, -0.1458	- 69, 25 s., 30, -0.1621
	24	9, 9 / 4, 4, 3	6 / 3
- School enrollment, tertiary (% gross), WDI	fragile, 29, 0.0068	fragile, 29, 0.0034	- 43, 3 s., 29, -0.0313
	28	11, 10 / 28, 28, 3	5 / 3
Innovation potential			
- ICT expenditure (% of GDP), WDI	- 69, 14 s., 27, -0.2644	- 69, 14 s., 27, -0.2623	- 69, 53 s., 27, -0.3049
	7	6, 6 / 45, 45, 8	0 / 8
- R&D. expenditure (% of GDP), WDI	- 48, 1 s., 30, -0.0624	- 46, 2 s., 30, -0.0543	- 52, 9 s., 30, -0.0765
	26	11, 9 / 9, 8, 3	2 / 3
- R&D. exp. (% of GNI), WEF	fragile, 28, -0.0267	fragile, 28, -0.0239	- 45, 6 s., 28, -0.0511
	27	4, 1 / 39, 39, 3	1 / 3
- Technological sophistication, WEF	- 65, ins., 30, -0.0965	- 57, ins., 30, -0.0913	- 64, 4 s., 30, -0.1435
	24	10, 9 / 5, 5, 0	6 / 0
- Company Spending on R&D, WEF	fragile, 30, -0.0206	fragile, 30, -0.0213	- 52, 3 s., 30, -0.0675
	26	12, 9 / 4, 4, 3	7 / 3
- University/Industry collaboration, WEF	- 67, 3 s., 30, -0.1511	- 67, 3 s., 30, -0.1571	- 64, 24 s., 30, -0.1869
	27	8, 7 / 4, 4, 2	4 / 2

Values/Moral			
Social Capital, social norms:			
- Trust other people in country, WVS (higher affirmation => higher indicator value)	- 63, 3 s., 25, -0.1095 28	- 62, 4 s., 25, -0.1263 8, 9 / 0, 0, 0	- 68, 20 s., 25, -0.1893 4 / 0
- Accepting a bribe justifiable, WVS (higher affirmation => higher value)	+ 46, 3 s., 30, 0.0948 23	+ 46, 3 s., 30, 0.1005 7, 7 / 17, 17, 16	+ 46, 23 s., 30, 0.1314 5 / 16
- Justifiable: claiming government benefits to which you are not entitled, WVS (higher affirmation => higher value)	- 50, 6 s., 30, -0.0555 28	- 46, 5 s., 30, -0.0576 5, 5 / 24, 23, 14	fragile, 30, -0.0188 6 / 14
- Justifiable: avoiding fare on public transport, WVS (higher affirmation => higher value)	+ 45, ins., 30, 0.0601 23	+ 45, ins., 30, 0.0607 10, 9 / 11, 10, 12	+ 45, 5 s., 30, 0.0742 6 / 12
- Impact of nepotism, WEF (less influence => higher indicator value)	- 69, 38 s., 30, -0.2429 33	- 68, 31 s., 30, -0.2500 14, 10 / 20, 20, 5	- 69, 41 s., 30, -0.2584 7 / 5
Tax moral:			
- Cheating on taxes justifiable, WVS (higher affirmation => higher value)	fragile, 30, -0.0111 26	- 45, 1 s., 30, -0.0125 7, 5 / 5, 5, 15	fragile, 30, 0.0013 5 / 15
Other moral aspects:			
- Family important in life, WVS (higher affirmation => higher value)	- 59, 25 s., 30, -0.1774 29	- 61, 23 s., 30, -0.1749 6, 5 / 5, 5, 4	- 49, 25 s., 30, -0.1505 8 / 4
- Spend time with friends, WVS (higher affirmation => higher value)	- 66, 33 s., 26, -0.2639 26	- 68, 28 s., 26, -0.2608 8, 6 / 1, 1, 3	- 65, 41 s., 26, -0.2700 2 / 3
- Belong to labor unions , WVS (higher affirmation => higher value)	+ 60, 1 s., 28, 0.1075 24	+ 63, 6 s., 28, 0.1467 14, 11 / 5, 5, 1	fragile, 28, 0.0391 8 / 1
- Belong to political parties , WVS (higher affirmation => higher value)	+ 68, 8 s., 28, 0.1652 11	+ 66, 4 s., 28, 0.1647 15, 12 / 4, 4, 1	+ 64, 11 s., 28, 0.1411 3 / 1
- Belong to none, WVS (higher affirmation => higher value)	- 50, ins., 26, -0.0484 9	- 51, ins., 26, -0.0533 11, 7 / 3, 3, 0	fragile, 26, 0.0219 6 / 0
- Income equality (should be made more equal), WVS (higher affirmation => higher value)	- 60, 24 s., 29, -0.1168 29	- 59, 22 s., 29, -0.1205 5, 4 / 4, 4, 4	- 58, 24 s., 29, -0.1060 4 / 4
- Importance of eliminating big income inequalities, WVS (higher affirmation => higher value)	- 54, 6 s., 22, -0.0753 16	- 51, 6 s., 22, -0.0835 13, 6 / 4, 4, 3	- 52, 11 s., 22, -0.1028 10 / 3
- Govt. should take more responsibility, WVS (higher affirmation => higher value)	+ 50, ins., 30, 0.0858 22	+ 52, 4 s., 30, 0.0935 8, 7 / 7, 6, 4	fragile, 30, 0.0360 5 / 4
- Govt. should be more open to public , WVS (higher affirmation => higher value)	+ 59, 3 s., 23, 0.1306 9	+ 53, 2 s., 23, 0.1038 6, 4 / 35, 35, 2	fragile, 23, 0.0603 4 / 1
- Govt. should allow more freedom for individuals, WVS (higher affirmation => higher value)	+ 68, 23 s., 23, 0.2845 27	+ 68, 15 s., 23, 0.2829 8, 8 / 20, 20, 0	+ 66, 29 s., 23, 0.2670 8 / 0
- Confidence in churches, WVS (higher affirmation => higher value)	+ 68, 3 s., 30, 0.1102 28	+ 66, 3 s., 30, 0.1114 9, 5 / 42, 41, 8	+ 63, 6 s., 30, 0.1112 4 / 8
Religion:			
- Believe in god, WVS (higher affirmation => higher value)	- 55, ins., 29, -0.0469 12	- 53, ins., 29, -0.0493 10, 6 / 14, 13, 2	- 46, 1 s., 29, -0.0218 3 / 2
- Importance of god in life, WVS	fragile, 30, -0.0105 26	fragile, 30, -0.0180 12, 8 / 18, 19, 4	fragile, 30, 0.0027 4 / 4
- Religion fractionalization, WVS	- 45, ins., 30, -0.0176 25	fragile, 0, 0.0000 12, 9 / 16, 17, 7	fragile, 0, 0.0000 6 / 7
- Spend time with people at church, mosque, synagogue, WVS	+ 54, 2 s., 24, 0.0506 10	+ 49, ins., 24, 0.0385 13, 13 / 6, 4, 0	+ 45, 4 s., 24, 0.0596 10 / 0
- Spend time with people at sport, culture, communal organizations, WVS	- 63, ins., 25, -0.1475 8	- 64, ins., 25, -0.1401 6, 7 / 4, 4, 0	- 58, 10 s., 25, -0.1431 2 / 0
- Belong to Religious organization, WVS	- 54, 3 s., 28, -0.0594 13	- 56, 2 s., 28, -0.0582 11, 9 / 4, 4, 0	- 63, 5 s., 28, -0.0855 4 / 0
Corruption:			
- Corruption , TI (less corruption => higher value)	- 69, 43 s., 30, -0.3644 22	- 69, 39 s., 30, -0.3792 13, 8 / 3, 3, 0	- 69, 54 s., 30, -0.3708 7 / 0
- Extent of Political corruption, WVS (higher perceived corruption => higher value)	+ 69, 60 s., 17, 0.6713 25	+ 69, 58 s., 17, 0.6324 14, 16 / 10, 13, 1	+ 69, 61 s., 17, 0.5341 6 / 1
- Impact of business costs of corruption, WEF (lower impact => higher value)	- 69, 39 s., 30, -0.3433 34	- 69, 31 s., 30, -0.3535 12, 8 / 2, 2, 1	- 68, 50 s., 30, -0.3617 7 / 1
- Reliability of bribes, WEF (higher confidence in reliabilty > higher value)	+ 69, 32 s., 28, 0.2148 24	+ 68, 32 s., 28, 0.2124 2, 1 / 22, 21, 8	+ 67, 38 s., 28, 0.2102 2 / 8
- Freedom from Corruption, Heritage (less corruption => higher indicator value)	- 69, 59 s., 30, -0.4250 24	- 69, 49 s., 30, -0.4361 12, 6 / 7, 7, 0	- 69, 61 s., 30, -0.4359 8 / 0
Other influences and subjective factors:			
Quantity and quality of public goods provision:			
- Quality of public schools, WEF	- 55, 9 s., 30, -0.1152 27	- 54, 2 s., 30, -0.1166 15, 11 / 10, 10, 3	- 63, 30 s., 30, -0.1895 9 / 3
- Confidence in education system, WVS	- 50, 1 s., 27, -0.0282 11	- 48, 1 s., 27, -0.0353 12, 9 / 5, 5, 0	- 53, 2 s., 27, -0.0505 6 / 0
- Overall infrastructure quality, WEF	- 53, 4 s., 30, -0.1161 26	- 53, 2 s., 30, -0.1087 12, 8 / 4, 4, 1	- 61, 12 s., 30, -0.1733 7 / 1
- Reliability of police services, WEF	- 66, 21 s., 30, -0.2421 27	- 68, 8 s., 30, -0.2417 11, 8 / 4, 3, 0	- 67, 30 s., 30, -0.2806 9 / 0
- Irregular payments in exports & imports, WEF (less irregularity => higher indicator value)	- 67, 26 s., 30, -0.2545 27	- 64, 22 s., 30, -0.2529 14, 7 / 4, 4, 1	- 66, 40 s., 30, -0.3234 7 / 1
- Differences in quality of healthcare available to rich and poor, WEF (less diff.=>higher value)	- 60, 1 s., 29, -0.0826 27	- 47, 1 s., 29, -0.0598 20, 15 / 46, 45, 16	- 59, 8 s., 29, -0.1171 3 / 16
- Confidence in social security system, WVS (higher confidence => higher indicator value)	- 65, 2 s., 27, -0.1289 14	- 64, 3 s., 27, -0.1315 11, 10 / 2, 2, 0	- 61, 25 s., 27, -0.1303 7 / 0
- Confidence in Government, WVS (higher confidence => higher indicator value)	fragile, 22, -0.0077 30	fragile, 22, -0.0018 11, 8 / 34, 37, 3	+ 54, 5 s., 22, 0.0439 5 / 3
- Confidence in Parliament, WVS (higher confidence => higher indicator value)	fragile, 30, -0.0096 26	fragile, 30, -0.0072 10, 12 / 7, 7, 6	fragile, 30, 0.0185 8 / 6
- Confidence in Political Parties, WVS (higher confidence => higher indicator value)	- 54, ins., 22, -0.0547 32	- 50, ins., 22, -0.0494 10, 10 / 23, 24, 7	+ 44, 3 s., 22, 0.0522 7 / 5

Efficiency of public goods provision:			
- Wastefulness of government spending , WEF (less waste => higher indicator value)	- 56, 11 s., 30, -0.1375 25	- 56, 6 s., 30, -0.1458 9, 9 / 4, 4, 2	- 65, 21 s., 30, -0.1628 7 / 2
Quality of State representatives:			
- Competence of public officials relative to private sector, WEF (higher comp.=>higher value)	- 44, 26 s., 29, -0.1470 29	- 48, 21 s., 29, -0.1631 12, 7 / 8, 8, 1	- 66, 48 s., 29, -0.2480 3 / 1
- Satisfaction with people in national office, WVS (higher satisf. => higher indicator value)	fragile, 18, 0.0802 26	fragile, 18, 0.0861 11, 14 / 7, 7, 3	+ 44, 36 s., 18, 0.1509 8 / 0
- Favoritism in decisions of government officials, WEF (less favoritism => higher value)	- 69, 54 s., 30, -0.3580 33	- 69, 46 s., 30, -0.3555 12, 9 / 5, 5, 1	- 69, 62 s., 30, -0.3603 8 / 1
- Diversion of public funds to companies etc., WEF (less diversion => higher value)	- 69, 35 s., 30, -0.3392 37	- 69, 31 s., 30, -0.3498 13, 9 / 0, 0, 0	- 69, 52 s., 30, -0.3512 8 / 0
- Public trust of politicians, WEF (more trust => higher indicator value)	- 69, 8 s., 30, -0.2074 24	- 66, 3 s., 30, -0.2015 11, 9 / 6, 6, 1	- 66, 22 s., 30, -0.1976 6 / 1
- Prevalence of illegal political donations, WEF (less prevalance => higher value)	- 69, 18 s., 30, -0.2510 22	- 68, 15 s., 30, -0.2402 13, 9 / 4, 4, 2	- 68, 37 s., 30, -0.2664 8 / 2
- Effectiveness of law-making bodies, WEF (higher effectivenss => higher value)	- 68, 38 s., 30, -0.2992 22	- 62, 38 s., 30, -0.2995 11, 6 / 4, 4, 1	- 65, 45 s., 30, -0.3366 7 / 1
- Quality of information regarding changes in policies & regulations, WEF (higher transparency => higher value)	- 67, 40 s., 30, -0.2992 28	- 62, 38 s., 30, -0.3061 16, 11 / 1, 1, 1	- 66, 45 s., 30, -0.3221 6 / 1
- Policy consequences of legal political donations, WEF (less influnce => higher value)	- 69, 23 s., 30, -0.2372 24	- 68, 19 s., 30, -0.2349 12, 8 / 12, 11, 1	- 69, 34 s., 30, -0.2310 7 / 1
- Misuse of legal political donations, WEF (less occuring => higher indicator value)	- 67, 7 s., 28, -0.2353 22	- 67, 7 s., 28, -0.2622 9, 6 / 25, 25, 0	- 69, 31 s., 28, -0.2744 4 / 0
Quality of enterprise representatives:			
- Confidence in major companies, WVS (higher confidence => higher indicator value)	- 60, 2 s., 30, -0.0571 25	- 57, 1 s., 30, -0.0487 13, 10 / 22, 22, 16	fragile, 30, -0.0162 7 / 16
- Ethical behavior of firms, WEF (better => higher indicator value)	- 69, 42 s., 30, -0.3432 22	- 69, 39 s., 30, -0.3540 9, 7 / 3, 3, 1	- 69, 57 s., 30, -0.3535 8 / 1
- Willingness to delegate authority, WEF (higher willingness => higher indicator value)	- 66, 6 s., 30, -0.1824 26	- 67, 3 s., 30, -0.1930 10, 8 / 4, 4, 3	- 67, 21 s., 30, -0.2400 7 / 3
- Extent of staff training, WEF (higher training => higher indicator value)	- 67, ins., 30, -0.1558 30	- 66, 1 s., 30, -0.1581 14, 13 / 5, 6, 3	- 65, 11 s., 30, -0.2179 7 / 3
- Cooperation in labor-employer relations, WEF (higher cooperation => higher indicator value)	fragile, 30, -0.0236 26	fragile, 30, -0.0219 13, 8 / 4, 4, 4	- 45, 4 s., 30, -0.0462 5 / 4
- Efficacy of supervisory boards, WEF (higher efficacy => higher indicator value)	- 46, 1 s., 30, -0.0980 24	- 49, ins., 30, -0.1136 11, 10 / 9, 8, 4	- 51, 20 s., 30, -0.1584 8 / 4
- Socioeconomic conditions, ICRG	- 64, 32 s., 30, -0.3279 22	- 57, 36 s., 30, -0.3454 14, 8 / 8, 8, 0	- 62, 39 s., 30, -0.3868 3 / 0
- Confidence in regional organizations (e.g. EU, Nafta), WVS (higher confid. =>higher value)	+ 63, ins., 25, 0.0682 6	+ 64, ins., 25, 0.0821 11, 8 / 14, 14, 1	+ 56, ins., 25, 0.0555 7 / 1
Decentralization			
- Decentralization of economic policymaking, WEF (more decentralized => higher value)	+ 69, 35 s., 30, 0.2065 26	+ 68, 33 s., 30, 0.1994 8, 6 / 28, 28, 4	+ 68, 48 s., 30, 0.2151 6 / 4
- Regulatory obstacles to business (local vs. federal), WEF (obstacles more located on central level => higher indicator value)	- 68, ins., 28, -0.0798 29	- 62, 1 s., 28, -0.0761 5, 4 / 41, 43, 7	- 61, 16 s., 28, -0.1045 3 / 7
- State of cluster development (limited vs. common and deep), WEF (deep=> high value)	- 59, 27 s., 30, -0.1208 27	- 56, 24 s., 30, -0.1080 7, 6 / 4, 4, 0	- 55, 26 s., 30, -0.1233 4 / 1
Crime:			
- Organized crime, WEF (less cost of crime => higher indicator value)	- 69, 38 s., 30, -0.2641 33	- 68, 34 s., 30, -0.2650 11, 9 / 4, 4, 0	- 69, 41 s., 30, -0.2776 6 / 0
- Drug trafficking, Eurostat (higher activity => higher indicator value)	- 53, ins., 27, -0.0818 22	- 55, ins., 27, -0.0884 11, 12 / 3, 3, 0	- 63, 4 s., 27, -0.1130 6 / 0
- Auto theft, Eurostat (higher crime => higher indicator value)	- 68, 12 s., 27, -0.1990 15	- 68, 17 s., 27, -0.2083 13, 13 / 3, 3, 4	- 67, 26 s., 27, -0.1885 12 / 4
Feelings and Expectations:			
- Feeling of happiness, WVS (higher affirmation => higher indicator value)	- 69, 37 s., 30, -0.4950 3	- 69, 34 s., 30, -0.4925 5, 4 / 3, 2, 2	- 69, 49 s., 30, -0.5137 10 / 2
- Satisfaction with financial situation of household , WVS (higher affirmation => higher value)	- 68, 6 s., 28, -0.3243 27	- 68, 5 s., 28, -0.3186 4, 4 / 19, 19, 3	- 62, 19 s., 28, -0.2571 6 / 3
- Satisfaction with your life, WVS (higher affirmation => higher indicator value)	- 69, 48 s., 30, -0.4513 28	- 69, 46 s., 30, -0.4554 8, 6 / 4, 4, 3	- 69, 50 s., 30, -0.4425 6 / 3
- Economic growth expectations, WEF	fragile, 30, 0.0065 26	fragile, 30, -0.0009 12, 9 / 25, 25, 3	- 56, 11 s., 30, -0.1160 7 / 3
- Interest in politics, WVS (higher affirmation => higher indicator value)	+ 68, 4 s., 30, 0.1385 22	+ 67, 8 s., 30, 0.1408 11, 9 / 4, 4, 3	+ 55, 11 s., 30, 0.0777 6 / 3
- Satisfaction with the way democracy develops, WVS (higher affirmation => higher value)	- 56, ins., 26, -0.0755 12	- 57, ins., 26, -0.0840 13, 10 / 3, 3, 0	- 48, ins., 26, -0.0704 6 / 0
Globalization:			
- Total index, KOF (higher globalization => higher indicator value)	+ 64, 2 s., 30, 0.1253 25	+ 61, 2 s., 30, 0.1092 7, 7 / 36, 36, 3	+ 48, 5 s., 30, 0.0617 11 / 3
- Economic globalization, KOF (higher globalization => higher indicator value)	- 42, 2 s., 30, -0.0602 25	- 44, 1 s., 30, -0.0704 8, 7 / 4, 4, 3	- 45, 5 s., 30, -0.0891 8 / 3
Inequality of income:			
- Gini, WDI (more unequal income distribution => higher index value)	- 49, ins., 30, -0.0344 26	- 50, 1 s., 30, -0.0517 22, 21 / 20, 20, 7	fragile, 30, -0.0084 11 / 7
- Richest 10% to poorest 10%, UN, WDI	- 44, 1 s., 29, -0.0145 30	fragile, 29, -0.0148 13, 12 / 51, 51, 30	+ 55, 21 s., 29, 0.0680 3 / 30
- Richest 20% to poorest 20%, WDI	- 45, ins., 29, -0.0137 30	fragile, 29, -0.0179 14, 13 / 50, 50, 30	+ 53, 11 s., 29, 0.0573 3 / 30

Gender:			
- Proportion of seats held by women in national parliament (%), WDI	+ 55, ins., 30, 0.0609 25	+ 44, 1 s., 30, 0.0632 13, 12 / 19, 19, 6	fragile, 30, 0.0530 10 / 6
- Gender empowerment measure, UN	+ 51, ins., 30, 0.0478 26	fragile, 30, 0.0567 13, 11 / 23, 23, 3	- 42, ins., 30, 0.0284 8 / 3
Aging:			
- Dependents to working-age persons, WDI	+ 65, 36 s., 30, 0.2618 29	+ 66, 31 s., 30, 0.2661 9, 9 / 3, 3, 2	+ 68, 47 s., 30, 0.2861 6 / 2
- Population ages 65 and above (% of total), WDI	- 65, 1 s., 30, -0.0657 25	- 59, 1 s., 30, -0.0558 9, 8 / 10, 10, 5	fragile, 30, -0.0240 4 / 5
Population structure:			
- Urban population (% of total), WDI	- 44, ins., 30, -0.0440 25	- 42, ins., 30, -0.0320 9, 8 / 10, 10, 4	- 43, 1 s., 30, -0.0214 6 / 4
Credit indicators:			
- Access to credit, WEF	fragile, 30, -0.0215 29	- 42, ins., 30, -0.0243 6, 5 / 6, 6, 1	- 53, 19 s., 30, -0.0992 7 / 1
- Domestic credit (% of GDP), WDI	- 69, 21 s., 30, -0.1619 25	- 66, 23 s., 30, -0.1498 10, 8 / 5, 5, 4	- 60, 9 s., 30, -0.0980 10 / 4
- Credit market regulations, Fraser (less govt. influence on allocation of credit =>higher value)	- 67, 14 s., 30, -0.2257 22	- 65, 13 s., 30, -0.2262 12, 9 / 3, 3, 0	- 68, 43 s., 30, -0.2962 8 / 0
- Venture capital availability, WEF	- 52, 6 s., 30, -0.1737 22	- 53, 3 s., 30, -0.1827 12, 10 / 4, 4, 2	- 68, 34 s., 30, -0.2502 6 / 2
- Standard deviation of inflation; Fraser (less variance => higher indicator value)	fragile, 30, -0.0252 28	fragile, 30, -0.0259 10, 10 / 6, 6, 4	fragile, 30, -0.0107 7 / 4

Note: The sensitivity of the influence of each variable on the shadow economy proxy, i.e. the ratio of currency holdings to M2 (cm2ifs), was tested in regressions using, one by one, the labor market and tax indicators (see Appendix 1). The equation was specified as follows: cm2ifs = gdprpppc + itstr + i + k, where i represents either one of the labor market indicators or an indicator of the tax and social security burden, and k represents the respective indicator of the list of economic institutions and other influences and subjective factors shown in this table. The sample includes up to a maximum of 38 OECD and Eastern European countries covering the period 1991-2007. Mean values are used. The inclusion of additional controls such as an indicator of inflation and of government size, which are consistently statistically insignificant, does not significantly influence these results. Relatively highly significant results are shaded.

Meaning of the statements in the cells, in the order of their appearance:

First row:

Sign of estimated coefficient of the respective labor market indicator; number of regressions with this sign out of a total of 200 estimated regressions; number of regressions where the estimated sign is statistically significant (at least at the 10% level of significance); number of N countries (in the majority of all regressions); and beta coefficient (the estimated effect in standard deviation units to be able to directly compare the relative quantitative influence of the estimated coefficients; see also the ranking of the indicators of this table).

Second row:

OLS regressions: Number of significant Ramsey regression specification-error tests (RESET) for omitted variables.

2SLS regressions:

First value: Number of significant endogeniety tests with regard to the respective tax variable and the respective variable representing other influences using Wooldridge's robust score chi-squared test. Second value: Same as before but using the robust regression F-test. Three values behind slash give the number of significant tests of the validity of the instruments using, respectively, a) Sargan's chi-squared test, b) Basman's chi square test, and c) Wooldridge's robust score test.

GMM regressions:

First value: Number of significant endogeniety tests using Sargan's C-statistic. Second value behind slash: Number of significant tests of the validity of the instruments using Hansen's J-statistic shi-squared test.

Specifics of the regressions:

OLS: Regressions estimated with robust standard errors.

2SLS and GMM: The indicator k was instrumented due to its potential endogeniety using the following instruments: legal origin of country, (i.e. either british, french, german, scandinavian, or socialist), language, latitude, religious and ethnic fractionalization. The equations were estimated using robust standard errors and small sample adjustments.

Table 7
Ranking of indicators of other institutional characteristics and subjective factors in influencing the SE 1/

Subgroup of indicator, see appendix 1	Indicator	Average beta coefficient	Rank
Corruption	**- Extent of Political corruption, WVS** (higher perceived corruption => higher value)	0.613	1
Feelings and Expectations	**- Feeling of happiness, WVS** (higher affirmation => higher indicator value)	-0.500	2
	- Satisfaction with your life, WVS (higher affirmation => higher indicator value)	-0.450	3
	- Freedom from Corruption, Heritage (less corruption => higher indicator value)	-0.432	4
Quality of justice system	**- Judicial independence, WEF** (higher independence => higher indicator value)	-0.381	5
Economic Institutions	**- Protection of property rights, Heritage**	-0.377	6
	- Corruption , TI (less corruption => higher value)	-0.372	7
Quality of State representatives	**- Favoritism in decisions of government officials, WEF** (less favoritism => higher value)	-0.358	8
Quality of administration	- Control of Corruption, WBGI	-0.354	9
Socioeconomic conditions	**- Socioeconomic conditions**	-0.353	10
	- Impact of business costs of corruption, WEF (lower impact => higher value)	-0.353	11
	- Integrity of the legal system, Fraser (higher integrity => higher indicator value)	-0.350	12
Quality of enterprise representatives	**- Ethical behavior of firms, WEF** (better => higher indicator value)	-0.350	13
	- Diversion of public funds to companies etc., WEF (less diversion => higher value)	-0.347	14
Administrative burden	**- Business Freedom, Heritage** (more "freedom" => higher indicator value)	-0.345	15
	- Government Effectiveness, WBGI	-0.333	16
	- Irreg. paym. in judicial decisions, WEF (less irreg. => higher indicator value)	-0.330	17
	- Irreg. paym. in public contracts, WEF (less irreg. => higher indicator value)	-0.319	18
	- Effectiveness of law-making bodies, WEF (higher effectivenss => higher value)	-0.312	19
	- Quality of information regarding changes in policies & regulations, WEF	-0.309	20
	- Investor protection index, IFC (better protection => higher indicator value)	-0.307	21
Constitutional system	**- Rule of Law, WBGI**	-0.301	22
	- Efficiency of legal framework, WEF (more efficient => higher indicator value)	-0.290	23
Elements of direct democracy	**- Democratic accountability, ICRG**	-0.290	24
	- Efficiency of legal framework, WEF (more efficient => higher indicator value)	-0.290	25
	- Impartial courts, Fraser (higher impartiality => higher indicator value)	-0.285	26
Values/Moral	**- Govt. should allow more freedom for individuals, WVS** (higher affirmation=>higher value)	0.278	27
Quantity and quality of public goods provision	**- Irregular payments in exports & imports, WEF** (less irregularity => higher indicator value)	-0.277	28
Aging	**- Aging: Dependents to working-age persons, WDI**	0.271	29
	- Investor protection index, IFC (better protection => higher indicator value) - Director Liability index	-0.276	30
Crime	**- Organized crime, WEF** (less cost of crime => higher indicator value)	-0.269	31
	- Spend time with friends, WVS (higher affirmation => higher value)	-0.265	32
	- Extra payments/bribes, Fraser (less bribes => higher indicator value)	-0.262	33
Punishment	**- Punishment: Number prisoners (per 100 th. population)**	0.257	34
	- Reliability of police services, WEF (higher reliability => higher indicator value)	-0.255	35
	- Prevalence of illegal political donations, WEF (less prevalance => higher value)	-0.253	36
	- Impact of nepotism, WEF (less influence => higher indicator value)	-0.250	37
	- Regulation of entry (=contract law, legal formalism), IFC (higher cost => higher value)	0.238	38
	- Policy consequences of legal political donations, WEF (less influence => higher value)	-0.234	39
	- Irregular payments in public utilities, WEF (less irregularity => higher indicator value)	-0.233	40
	- Regime Durability, Polity	-0.231	41
	- Political action signing a petition (have done)	-0.215	42
Trade related adminis-trative burden	- Trade freedom, Heritage	-0.214	43
	- Reliability of bribes, WEF (higher confidence in reliabilty > higher value)	0.213	44
	- Investor protection index, IFC (better protection => higher indicator value) - Disclosure index	-0.213	45
Decentralization	**- Decentralization of economic policymaking, WEF** (more decentralized => higher value)	0.207	46
	- Willingness to delegate authority, WEF (higher willingness => higher indicator value)	-0.205	47
	- Competence of public officials relative to private sector, WEF (higher comp.=>higher value)	-0.186	48
Tax enforcement	**- Verification activities per taxpayer, OECD**	0.186	49
Complexity of tax system	**- Complexity of tax system: tax payments (number), WDI**	0.179	50
	- Burden of government regulation, WEF (less burdensome => higher indicator value)	-0.174	51
	- Regulatory quality, WBGI (higher quality => higher indicator value)	-0.170	52
	- Family important in life, WVS (higher affirmation => higher value)	-0.168	53
	- Number of legal procedures to collect an unpaid check (contract law, legal formalism), IFC	0.162	54
	- Time req. to start a business, WEF (higher bureaucracy => higher indicator value)	0.160	55
Educational system	**- School enrollment, secondary (% gross)**	-0.149	56
	- Administrative requirements, Fraser (less bureaucratic cost => higher indicator value)	-0.148	57
	- Quality of public schools, WEF	-0.140	58
Credit indicators	**- Domestic credit (% of GDP)**	-0.137	59
	- Confidence in social security system, WVS (higher confidence => higher indicator value)	-0.130	60
	- Confidence in justice system, WVS	-0.130	61
	- Tax auditors per taxpayer, in o/oo, OECD	-0.124	62
	- Efficacy of supervisory boards, WEF (higher efficacy => higher indicator value)	-0.123	63
	- Having Democratic system in Country is good, WVS (higher affirmation => higher value)	0.122	64
State of cluster development	**- State of cluster development** (limited vs. common and deep), WEF (deep=> high value)	-0.117	65
Values/Moral	- Income equality (should be made more equal), WVS (higher affirmation => higher value)	-0.114	66
	- Tax administration staff per taxpayer, OECD	-0.081	67

1/ Ranking based on the quantitative importance of the indicators as measured by the average beta coefficient (absolute value) of the respective OLS, 2SLS,and GMM estimations. Only indicators with consistently estimated signs were included. The beta coefficient (<1) represents the estimated average change in standard deviation units.Indicators are marked bold when they are the first representative of the indicator subgroup to which they belong in the list of all indicators, appendix 1.
2/Vulnerable employment is unpaid family workers and own-account workers as a percentage of employment. No data available for important countries, e.g. Canada, all scandinavian countries, UK, USA.
Source: Own estimates.

enforcement, punishment, availability of credit, educational system, constitutional system, and others. The degree of robustness of the major groups of indicators can be judged visually in table 6 by looking at the extent of highlighted results. For instance, the importance of corruption can thus immediately be seen since all indicators in this subgroup are in all estimations significant according to the adopted definition and therefore marked.

All five indices of the top ranking group of **corruption** suggest that it fuels shadow economic activity. Given the theoretical debate whether corruption it is a complement or a substitute to the shadow economy (see table 1, section 2, the 6th major indicator group "values and moral"), our finding supports the view that corruption and the SE are complementary and thus a substitute for the official economy not only in low income countries as suggested by Dreher and Schneider (2006), but also in high income countries. Given the many forms of corruption occurring especially in relatively rich industrial countries as documented, for instance, in the reports by transparency international, governments should use this result as further evidence of the importance to improve institutions so as to reduce incentives for corruption in the first place rather than simply raising punishment and fines, which may be ineffective.[14]

Second ranking is our indicator of **happiness**. This high rank corresponds to the increasing attention received by the economics of happiness and attempts to augment GDP by "happiness" (e.g. Kahneman and Krueger (2006).[15] Specifically, the indicators 'happiness' and 'satisfaction with life' are second and third ranking in table 7 and second and fourth in our overall ranking. In our country sample happiness is highly positively correlated with per capita income, but happiness is not highest in the richest countries. It is highest in the relatively small island countries Iceland, New Zealand and Ireland (in the two decades before the crisis of 2009). Indeed, Iceland and New Zealand have very small estimated shadow economies.[16]

Third ranking is the **quality of justice system** (subgroup of group 4 in the list of indicators, appendix 1). This further corroborates the above hypothesis of seeing the standard assumed causes of the SE as conditional, because the impact of, for instance, a relatively high tax burden on the shadow economy may be mitigated by high quality of justice system, administration and other factors. For instance, the indices of this subgroup judicial independence, integrity of the legal system, irregular payments in judicial decisions and impartial courts are highly ranked taking the fifth to 26th place in

[14] As one of many examples we mention the effective degree of independence of supervisory boards from executive boards. If, for instance, supervisory board members are traditionally former executive board members and even come from the same company, there will always be the impression of bias promoting manager capitalism. Another example is to realize that daily widespread corruption in wealthy countries is often directly connected to governments: for instance, enterprises which are through personal links or otherwise close to a national, regional or local government receive contracts without or with biased open tendering.

[15] Bhutan is the first and only country whose government focuses, already since the 1980s, on "gross national happiness" instead of GDP. It is based on the Buddhist principle and includes the environment, community participation and the need for balance between work and other activities. In 2009, as a reaction to the financial crisis, France suggested for the G20 to augment GDP by "happiness" and commissioned a study by Joseph Stiglitz on how to ensure that governments take account of the well-being and happiness of their citizens. However, comparing the international ranking of happiness using the "happy planet index" from the New Economics Foundation (see Abdallah et al., 2009) with the estimated sizes of the SE in 145 countries by Schneider (2007), we do not find that countries with relatively high happiness have relatively low shadow economies even in clusters of similar countries. In the "happy planet index" developing countries, especially from the Carribean, Middle- and South America and Bhutan rank among the top. Of the industrial countries highest ranking are the Netherlands (43), and Malta (44). Hence, achieving a high degree of "happiness" is not a sufficient condition for a relatively small SE.

[16] However, it is difficult to argue that high happiness and a low shadow economy may result from the island situation that could promote very homogenous societies, because New Zealand has, for instance, a relatively high degree of ethnical diversity. This underlines that a given degree of the SE cannot be explained by one or few major determinants but there are several or many relevant influences which are conditional. As noted before, empirical analyses with extensive specifications are, however, impossible with the available data.

table 7, where in all cases the estimated minus sign means that higher quality reduces the SE. Interestingly and as shown in the overview of theories, table 1 above, the topic of the quality of the justice system in wealthy countries has been taken up relatively recently by theorists (Glaser et al., 2000) and empiricists (Aaken et al., 2008), who draw analogous conclusions. The relatively high significance of the indicators of the quality of the justice system suggests it is necessary to take the perceptions of people seriously when studying influences on shadow economic activity. There cannot be doubt that even in the wealthy countries there is ample room for improvement of these perceptions.[17]

Fourth ranking is **property rights protection**. The robust property rights protection indices in table 7 rank on places 6, 30, and 45. Consistent with the theory of property rights, their protection reduces the SE. There is a debate in the institutional economics literature on which specific institutions are best explaining long run economic growth performance. Property rights were found to be relatively more important than contracting institutions or contract law, which supports private contracts (Acemoglu and Johnson, 2005). It is interesting to note that our results are consistent with this finding since property rights indices tend to have higher ranks of significance and quantitative impact in reducing the shadow economy than the indicators of contract law ('regulation of entry', rank 38, and 'number of legal procedures to collect an unpaid check', rank 54).

The fifth, sixth, and eighth rank in table 7 have indicators, which are very similar to each other: '**quality of state representatives**', '**quality of administration**', and '**quality of enterprise representatives**' (see the detailed indicators of these subgroups in the last main group 7 'other influences and subjective factors' in appendix 1). This underlines the importance of perceptions of economic agents for the shadow economy regarding the actions of people in power, foremost those in public office.[18] Note that these indicators refer to perceptions of people and not to proven facts.

The findings show that the perception of government effectiveness, judicial impartiality, quality of both state and enterprise representatives are relatively high ranking influences on the SE in wealthy OECD countries and not only in developing countries. Hence, using the ample room for improvements in these areas could contribute in the medium term to reducing the SE which may be particularly true after events like the financial crisis and recession of 2008-09 since it is clear to taxpayers that they bear the costs.[19]

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[17] Examples may be state prosecutors who, despite formal independence, are de facto dependent on supervisors who follow orders by others and politicians; and the cases of CEO's being acquitted (often through 'voluntary' payments) despite fraudulent breach of trust to the disadvantage of shareholders (manager capitalism), whereas the courts confirm the firing of long-serving employees without notice even for trivial offenses (e.g. suspected embezzlement of a deposit receipt for an empty bottle).

[18] Examples of robust indicators are 'favoritism in decisions of government officials' (rank 8), control of corruption (rank 9), 'ethical behavior of firms' (13), 'diversion of public funds to companies etc.' (14), 'government effectiveness (16), 'irregular payments in public contracts' (18), 'quality of information regarding changes in policies and regulations' (20), 'efficiency of legal framework' (25), 'prevalence of illegal political donations' (36), 'policy consequences of legal political donations' (39), 'irregular payments in public utilities' (40), 'willingness to delegate authority' (47) 'competence of public officials relative to private sector' (48), and 'efficacy of supervisory boards' (63). The surprisingly large number of scandals involving managements of well known enterprises during the past decade and the financial crisis of 2008/09 may be an incentive to analyze better the effective degree of openness and competition of markets for enterprise managers and supervisory board members.

[19] The case of the financial crisis 2008-09 may be an example showing room in improving perceived government effectiveness: international organizations (especially the IMF and the BIS with its Institute for Financial Stability, IFS) and national financial supervisory institutions (central banks together with other supervisory institutions) had a mandate – which was made more explicit after the Asian financial crisis of 1997 - to effectively monitor the stability of the financial system. But even despite warnings from scientists in 2006 and 2007, which were delivered at IMF headquarter and at meetings of central bank governors at the BIS (e.g. New York Times, 2006 on Roubini's warnings; and White, 2006), these institutions failed to propose and to take any action before the crisis. Ironically and possibly setting wrong incentives, the crisis gave the IMF more power and saved it from having to reduce its staff, which otherwise would have been necessary due to decreased demand for its loans. Although some of these institutions usually emphasize the importance of personal responsibility,

Socioeconomic conditions have the seventh rank with an estimated quantitative impact of about the same size as the second ranking tax and labor market indicators. Their improvement reduces the SE.

The **administrative burden** belongs with taxes to the standard causes of the SE in most of the relevant empirical literature. In our ranking (see table 7) the highest place of an indicator of this subgroup is 'business freedom' on the 15th place. Other indicators of this subgroup rank considerably lower, i.e. extra payments/bribes (33), the burden of government regulation (51), and administrative requirements (57). All of them show that a higher burden promotes the SE.

One particular goal of this study was to analyze the influence of the **constitution**, in particular **elements of direct democracy**, which, to the best of our knowledge were not yet analyzed in a cross section panel, since only one OECD country, Switzerland, has this political system of a direct democracy, and therefore studies concentrate on this country. Since other countries have elements of direct democracy, we use indicators of these elements.
The eight tested constitutional system indicators show that the polity scores given to countries by the polity project of the University of Maryland and the indicators of the World Bank for political stability and rule of law have a dampening effect on the shadow economy, where half of them are robust.
All of the four available indicators concerning direct democracy, show that it reduces the SE; two of them are robust, namely 'democratic accountability' and 'political action signing a petition', which are ranked 24th und 43rd, respectively.

The subgroup **values and moral** is next ranking. The first two of its indicators, 'government should allow more freedom for individuals' (rank 27), and 'impact of nepotism' (37), have robust positive signs, indicating that dissatisfaction of people with their freedom and nepotism tend to promote the SE. By contrast, the indicators 'spend time with friends' (32), and 'family important in life' (53) have robust and expected negative signs, showing that sociality reduces the SE. The indicator 'income equality should be made more equal' (66) is presumably highly correlated with the degree of inequality. It has a negative sign although theory predicts higher income inequality to push up the SE (see table 1, section 2). Other indicators of income inequality are insignificant. An admittedly tentative explanation of this unexpected minus sign could be that as the income distribution is felt to be disturbingly uneven, people nevertheless may have benefited from more liberal markets through employment opportunities in the official economy, which would reduce the SE.

Another major goal of this paper was to test whether indeed the **quality and quantity of public services** is a conditional factor to the burden of taxes. Although this could not be tested through use of interaction models, the respective subgroup of indicators is relatively highly ranked on the 12th place in table 7. All of the first seven indicators in this subgroup have a negative sign, meaning that higher quality and quantity reduces the SE. Four of them are robust in our definition, namely quality of public schools, reliability of police services, irregular payments in exports and imports, and confidence in the social security system, taking ranks from the 8th to the 61st place. It is interesting to see that the other three indicators in this subgroup, whose sign is fragile, are less close to the meaning of quality of public services, namely confidence in government, confidence in parliament and confidence in political parties. Overall, this result is taken as supporting the hypothesis that indeed governments can regard the quality of public services as a conditional factor to the tax burden.

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after the crisis consequences of governments regarding personal responsibilities at these institutions and within themselves hardly became known. Governments have also not been able to internationally coordinate and implement substantive regulatory reforms despite elaborate proposals from scientists. On the EU level a necessary institution to effectively coordinate economic policies or at least provide EU countries with all information about planned economic policies of other EU countries is still missing. Moreover, some governments have not reformed exceptions concerning financial supervision (e.g. in Germany among the largest loss making institutions due to the financial crisis of 2008/09 were state-owned or state-related banks because they or their subsidiaries had most heavily invested in US sub-prime bonds). Nevertheless, KfW, for instance, is exempted from normal banking supervision, continues to be supervised by the Finance Ministry, and has a politically dependent supervisory board of 37 persons. These are merely few examples that may indicate room for governments to improve their perceived effectiveness.

Also a plausible result is that the **aging** variable, dependants to working age persons, has a very robust positive impact on the SE, ranked 13th: aging thus tends to fuel the SE. Following the results just reported, the government can, however, counteract this effect, for instance, through raising the confidence in the social security system and the quality of other public goods.

Of the remaining indicator subgroups in table 7 we comment a few results, some of which are very interesting:

Organized crime is promoting the SE, a plausible result which enables us to estimate below the crime related part of the shadow economy.

Regarding **punishment** there is only one and for our purpose relatively weak indicator available, which shows a robust, positive effect on the SE. Of course, all results of these estimations need to be cautiously interpreted but this surprising result is nevertheless fully consistent with the new theory on punishment and tax morale (see table 2, section 5, last subgroup punishment). This literature argues theoretically and shows empirically that punishment needs to be seen critical, especially regarding minor offenses, if it is supposed to be successful in reducing offenses and not as a means to retaliate. Taken at face value the positive sign says that punishment does not help in reducing the SE but even contributes to it. This may corroborate the question as to potential alternatives to recent policies of OECD countries raising further punishment levels for shadow economic activity and tax evasion.

Decentralization has a theoretically ambiguous effect on the SE (see category 7, subgroup 4, table 2). On the one hand, it can reduce revenue maximizing behavior of governments thus dampening the SE. On the other hand, it may result in more corruption, higher influence of interest groups, and lower quality of government decisions, which would tend to promote the SE. Given an estimated positive robust sign of our proxy for decentralization (degree of decentralization assessed by executives selected by the World Economic Forum), we find support for the second theoretical view, i.e. the SE is positively affected by decentralization. It would be plausible if corruption is a main channel from decentralization to the SE, given its high positive correlation with the SE.

For **tax enforcement**, ranked 19th, a negative sign was expected, if it has a deterrence effect and if it does not cause adverse reactions of people that may over-compensate deterrence. Indeed, two of the three indicators have a robust negative sign, i.e. ‘tax auditors per taxpayer’ (rank 62) and ‘tax administration staff per taxpayer’ (67). However, a surprising and interesting result is the estimated positive robust sign of the tax enforcement indicator ‘verification activities per taxpayer’ (49), suggesting that verification activities promote the SE.
This result can be plausible and consistent with the theory and new experimental empirical evidence, if the two first mentioned enforcement indicators differ qualitatively from the last one in the sense that ‘verification activities’ would measure those actions of tax authorities, which from the viewpoint of the taxpayer tend to be disproportionate or unwarranted. If this indicator reflects also actions, which taxpayers perceive as unjustified, adverse effects can be created (more tax evasion), which may overcompensate the deterrence effect. This is consistent with the literature on tax morale, social norms and social interactions (summarized in table 2, sections 6 and 7), which finds strong evidence for fairness effects, intrinsic motivations, reciprocity and cooperative behavior: Hence, the taxpayer reacts to actions perceived as unwarranted by increasing tax evasion and shadow economic activity. This assumes that risk aversion is not pronounced, an influence we cannot test, because of the lack of a satisfying indicator.

The 20th ranked subgroup **complexity of the tax system** has a positive robust sign, supporting the theoretical view that complexity increases perceived unfairness, uncertainty, and can even undermine the constitution. Thus, the opposing theoretical possibility for tax complexity to reduce the SE through use of tax loopholes and promotion of legal tax avoidance appears to be overcompensated.

Finally, the **educational system** has the expected negative and robust sign, which is a pleasant result since endeavors to raise the level of education will dampen the SE although the quantitative impact is one of the lowest of the robust variables in table 7.

4.4 Estimated size of the shadow economy and causes

Before summarizing the estimates of the size of the SE it needs to be emphasized that these estimates are directly proportional to the value of the assumed income velocity. Hence, they are highly sensitive to it as can be seen in the following three scenarios. Since this assumption remains speculative, the estimates are only indicative.

Thorough discussions of the velocity assumption and of the sensitivity of the results to it are hard to find in the literature as are analyses explaining the large differences in currency velocity of otherwise similar countries. Consider, for instance, the large differences in average currency velocity values during 1991-2007 of the UK (38), France (31), USA (19) and Germany (15). Since recently there is a rebirth of estimates of the SE using structural models, so-called Mimic models (multiple indicators and multiple causes, first applied on the SE by Frey and Weck-Hannemann, 1984). But this approach too cannot avoid the problem of making a velocity assumption, because a Mimic model always generates an index of the SE whose transformation to ratios of the SE to official GDP necessitates using other SE ratios as benchmarks, which are usually taken from studies using the currency method. Hence, estimates of the size of the SE on the basis of a Mimic model are directly tied to a currency model besides their own problems (Breusch, 2005a, 2005b, 2006).

We discuss the problem of the necessary velocity assumption in appendix 3 and present a range of velocity assumptions used to produce three scenarios I-III. This demonstrates how sensitive the SE estimates are and thus neither currency demand nor Mimic models enable the economic science to provide a rather precise estimate of the size of the SE for each country. However, appendix 3 demonstrates criticism of choosing a relatively high value of velocity because this overstates the work currency does in the generation of observed income (e.g Breusch, 2005, p.33). Moreover, there is a clear declining trend of velocity. And appendix 4 discusses which velocity assumption is consistent with the micro evidence on the size of the SE: it suggests choosing a relatively low velocity such as M2.

It is thus interesting to see that both discussions, which are independent of each other, i.e. that of the velocity assumption in appendix 3, and that of the micro evidence in appendix 4, suggest scenario 1 as the only one which is consistent with both. Hence, scenario I would have more appeal than the other two scenarios.

First, however, table 8 shows the estimation results of equation 3 with few selected specifications and estimation methods. Model 2 was selected to produce the estimates. As explained before, given the limited number of observations, choosing an extended specification is difficult since inclusion of more independent variables tends to lower the statistical significance of individual variables and of the estimated equation. Nevertheless, all models yield similar results that largely confirm theoretical expectations: Crime is estimated to statistically significantly increase currency demand, enabling us to simulate two shadow economies, i.e. one that is related to organized crime, and one which is not crime related. In model 2, the administrative and the tax burden are statistically significantly positively associated with currency holdings. Also social security contributions paid by employers significantly promote currency demand. Tax enforcement is estimated to reduce the SE, but not statistically significant. But the quality of public services, proxied here by the quality of public schools, is statistically significantly reducing the SE. In fact, this influence has the highest significance in all models. Our proxy for elements of direct democracy negatively affects the SE, albeit not statistically significant. Dummies for Eastern Europe and year dummies for the introduction of the Euro in EMU countries are included to improve the forecasting power of the regression. Test results of the overall quality of the regressions are shown at the bottom of table 8 showing that their statistical properties appear satisfactory, i.e. all test statistics are not statistically significant.

Table 8
Pure Cross Section Regression Results of Currency to M2 Functions

	model 1 (OLS)	model 2 (OLS)	model 3 (OLS)	model 2 (2SLS)	model 2 (GMM)
GDP real per capita at PPP	0.0000029	0.0000034	0.0000037	0.0000038	0.0000043
	(2.64)**	(3.00)**	(3.15)**	(2.37)**	(2.75)**
	0.5693	0.6578	0.7245		
real short term interest rate	0.0037	0.0061	0.0056	0.0066	0.0100
	(0.72)	(1.39)	(1.10)	(1.53)	(2.03)*
	0.1468	0.2423	0.2312		
Organized crime, WEF	-0.0079	-0.0109	-0.0064	-0.0114	-0.0099
(higher value => lower cost of crime)	(-2.01)*	(-3.23)***	(-1.76)	(-3.48)***	(-4.29)***
	-0.1944	-0.2694	-0.1520		
Administr. Burden: Business Freedom, Heritage	0.0002				
(higher value => lower burden)	-0.2200				
	0.0380				
Administr. Burden: Time req. to start a business,		0.0006		0.0008	0.0007
WEF (higher value => higher burden)		(2.06)*		(3.51)***	(2.98)**
		0.2512			
Administr. Burden: No. of procedures to resolve			0.0010		
a dispute, WEF (higher value => higher burden)			-0.9700		
			0.1120		
Tax burden: Total tax revenue, % of GDP	0.0009	0.0011	0.0006	0.0012	0.0007
	(1.550)	(1.79)*	(1.130)	(1.86)*	(1.46)
	0.1965	0.2475	0.1502		
Social security contrib. employers, % of GDP	0.0029	0.0021	0.0028	0.0021	0.0024
	(2.05)*	(2.02)*	(2.28)**	(1.89)*	(3.06)***
	0.2959	0.2224	0.3062		
Tax enforcement: Number of tax auditors per	-4.2687	-2.8239	-4.2535	0.0000	-3.6721
taxpayer, OECD	(-1.31)	(-0.81)	(-1.26)	0.0000	(-1.25)
	-0.1596	-0.1056	-0.1711		
Quality of public goods: Quality of public	-0.0305	-0.0253	-0.0281	-0.0234	-0.0228
schools, WEF (higher value => higher quality)	(-3.18)***	(-2.91)**	(-3.32)***	(-2.68)**	(-2.19)**
	-0.7301	-0.6044	-0.7150		
Complexity of tax system: Tax payments;	0.0004	0.0005	0.0005	0.0005	0.0005
number, WDI (higher value => higher complexity)	(0.86)	(1.27)	(1.09)	(1.51)	(1.47)
	0.0974	0.1224	0.1485		
Direct democracy: Political action signing a	-0.0374	-0.0317	-0.0392	-0.0333	-0.0440
petition (have done), WVS	(-1.27)	(-1.19)	(-1.14)	(-1.16)	(-1.70)
	-0.2020	-0.1716	-0.2309		
Dummy Eastern Europe	0.0810	0.0753	0.0915	0.0765	0.0792
	(3.01)**	(3.61)***	(3.58)***	(3.23)***	(2.97)**
	0.8029	0.7465	0.8236		
Dummy Euro introduction in EMU countries	0.1353	0.1044	0.1140	0.0924	0.0923
	(1.78)	(1.86)*	(1.52)	(1.91)*	(1.37)
	0.3731	0.2879	0.3329		
Constant	0.1360	0.1027	0.0997	0.0767	0.0729
	(2.14)*	(2.12)*	(1.99)*	(1.87)*	(1.55)
N	25	25	23	25.0000	25.0000
R-squared	0.788	0.823	0.790	0.8050	0.7800
F-statistic	9.595	15.321	11.166	18.6700	45.1290
p-value_of_model	0.0002	0	0.0003	0.0000	0.0000
RMSE	0.015	0.014	0.015	0.0150	0.0160
F-statistic_RESET	0.838	0.922	1.914		
p-value_RESET	0.506	0.469	0.216		
Tests of endogeneity of regressors:					
p-value of robust score chi square test (1)				0.5573	
p-value of robust regression F test (1,11)				0.7400	
p-value of GMM C statistic chi square test (1)					1.0000
Tests of overidentifying restrictions:					
p-value of score chi square test (7)					0.1719
p-value of Hansen's J chi square test (7)					0.2205

* p<0.10, ** p<0.05, *** p<0.01

Note: Equations estimated with robust standard errors. T-statistics in parantheses below estimated coefficients. In the third line (in OLS regressions) beta coefficients are shown.

Inclusion of additional variables to control for inflation and government size does not significantly affect the results and these variables are consistently statistically insignificant.

In the 2SLS and GMM regressions real GDP per capita was instrumented. The tests for endogeniety and validity of instruments are, however, also consistently insignificant when we instrument the presumed causes of the shadow economy. This means that the endogenous regressors in the model should be treated as exogenous and that the instruments are valid, which corroborates the OLS results in this table.

Source: own calculations.

For our simulations we chose model 2, which has the highest R squared. Only the statistically significant independent variables are considered in the simulation, i.e. the variables organized crime, administrative burden, tax burden, social security burden and the quality of public services.

The results of the three scenarios (scenario 1, table 9 below, and scenarios 2-3, tables 10-11, appendix 4) demonstrate their sensitivity to the velocity assumption: the estimates in scenario III are about 3 times higher than those in scenario I, although we chose only from a medium range of velocities (M2 velocity used in scenario 1, and a weighted average of M1 and currency velocity in scenario 3 to reproduce Schneider's estimates for Germany). We discuss the velocity assumption in appendix 3.

Summarizing briefly the main features of these tables we find that in industrial countries the SE related to organized crime tends to be mostly about half of the estimated total SE with some exceptions, e.g. USA, where it would be over 70% of the total, and Korea, Greece, and Japan (about 50-60% of the total, table 9). The estimated organized crime related SE is higher in Eastern European and developing countries compared to industrial countries (with the exception of Japan). However, for many of these countries we have no total SE estimate because of missing or inconsistent data regarding some or all of the considered individual causes for it.

An interesting case is that of Denmark, where the non-crime related SE is estimated to be zero and the crime-related SE is also very small, much less than 1% of official GDP. Of course, this is also the result of the method and the time period available for calculating these figures, because for our period of 1991-2007 we can obtain positive estimates of the individual causes of the SE only, if, for instance, the tax or other burden was during this period at some point higher than the period average. If there is no variation, the resulting SE will be zero. Nevertheless, the zero finding for Denmark and the relatively low estimates of the SE in the other Scandinavian countries demonstrate at least the possibility and confirm one main hypothesis of this paper, that a relatively high tax burden is not necessarily resulting in a high SE but this is *conditional* on many other factors of which for technical reasons only very few can be considered in these simulations.

Another lesson is that the SE, especially the non-crime related SE, which is of greatest interest from an economic policy point of view, tends to be considerably lower than suggested by other studies that use the currency method, including Mimic models. Scenario 3 yields very large estimates whose average, regarding the countries of this sample, is similar to that calculated by Schneider et al. (2010).[20] But the currency velocity assumed to obtain these large figures is more than 7 times larger than that of scenario 1 although only the first scenario is consistent with both the micro evidence and the evidence on income velocity of currency (appendix 4).

Besides pointing to a smaller magnitude of the SE than is often argued in macro studies, Table 9 may also be used to look at the relative quantitative importance of the causes of the SE: For instance, for major industrial countries like the USA, UK, Italy, Germany and France the perception of public services quality by economic agents appears to have a much higher quantitative impact than the tax and social security burden. This also corroborates the hypothesis of this paper that the influence of taxes can in principle be compensated. It is also interesting to see that the administrative burden in countries like New Zealand, which implemented since more than two decades comprehensive reforms of its public sector to make it more responsive to citizens, and Switzerland with its referenda, is estimated to have a zero impact on the SE. However, a country comparison of this particular influence also demonstrates a clear weakness of these estimates, since there are relatively similar countries (e.g. France and Germany) with very different estimated contributions of the administrative burden to the SE: one problem causing these anomalies is the given relatively short time period of only 17 years. Hence, the figures of table 9 are merely indicative and not more than suggestions for more discussions of potential causes of the SE and their quantifications.

[20] For Germany and regarding the year 2007, the results are identical.

Table 9: Scenario I of the size of the shadow economy (SE) and individual causes (using average M2 velocity) 1/
(in percent of official GDP)

	Administra-tive burden (wef605)	Tax burden (ttrgdp)	Social secu-rity burden (ssccgdp)	Quality of public servi-ces (wef508)	Non "crime-" related SE	"Crime" shadow economy (wef111)	Total Shadow Economy	Share of "crime" SE in total SE
Australia	0.00	0.36	n.a.	0.45		1.0		
Austria	0.05	0.30	0.11	0.48	0.9	0.6	1.6	0.40
Belgium	0.38	0.45	0.14	0.79	1.8	1.2	2.9	0.40
Bulgaria	n.a.	n.a.	n.a.	1.05		3.8		
Canada	0.00	0.00	0.00	0.00	0.0	2.4	2.4	
Cyprus	n.a.	n.a.	n.a.	2.55		2.8		
Czech Republic	n.a.	n.a.	n.a.	n.a.		2.8		
Denmark	0.00	0.00	0.00	0.00	0.0	0.3	0.3	1.00
Estonia	0.61	n.a.	n.a.	0.28		1.3		
Finland	0.00	0.18	0.09	0.29	0.6	0.2	0.8	0.30
France	0.03	0.12	0.04	0.31	0.5	0.8	1.3	0.61
Germany	0.57	0.16	0.15	0.38	1.3	1.0	2.3	0.45
Greece	0.00	0.77	0.27	0.41	1.5	1.9	3.3	0.56
Hungary	n.a.	n.a.	n.a.	n.a.		2.3		
Iceland	0.00	0.45	0.07	0.40	0.9	0.3	1.2	0.25
Ireland	0.70	0.66	0.09	0.76	2.2	1.4	3.6	0.39
Italy	0.00	0.30	0.08	1.02	1.4	2.5	3.9	0.64
Japan	0.40	0.45	0.39	1.11	2.3	3.3	5.7	0.59
Korea, Republic of	0.29	0.56	0.26	0.75	1.9	2.1	3.9	0.53
Latvia	0.03	n.a.	n.a.	0.36		1.9		
Lithuania	0.00	n.a.	n.a.	0.43		2.0		
Luxembourg	0.00	0.49	0.07	0.40	1.0	0.8	1.8	0.46
Malta	n.a.	n.a.	n.a.	0.74		1.5		
Mexico	0.58	0.11	n.a.	0.21		2.6		
Netherlands	0.04	0.52	0.36	0.61	1.5	2.1	3.6	0.57
New Zealand	0.00	0.32	n.a.	0.50		1.0		
Norway	0.23	0.24	0.08	0.55	1.1	0.5	1.7	0.33
Poland	0.00	0.29	n.a.	0.65		2.6		
Portugal	0.59	0.68	0.54	0.60	2.4	1.0	3.4	0.28
Romania	0.20	n.a.	n.a.	0.53		2.3		
Slovak Republic	0.56	0.46	0.51	0.92	2.5	2.8	5.3	0.54
Slovenia	0.02	n.a.	n.a.	0.91		1.9		
Spain	0.50	0.26	0.15	0.39	1.3	1.4	2.7	0.51
Sweden	0.03	0.22	0.27	0.37	0.9	0.6	1.5	0.39
Switzerland	0.00	0.17	0.18	0.31	0.7	0.9	1.6	0.59
Turkey	0.11	0.53	0.17	0.41	1.2	1.9	3.1	0.60
United Kingdom	0.36	0.45	0.07	0.58	1.5	1.6	3.0	0.52
United States	0.02	0.23	0.02	0.40	0.7	1.9	2.6	0.74

1/ Velocity assumption of currency used in the unofficial economy: average of M2 velocities of two country groups: industrial countries, including EMU countries: 1.48; for developing countries, including Eastern Europe: 2.07.

Note:

Given very large differences in velocities even among otherwise relatively similar countries, which are not well understood and have not been clarified, we used the average velocity of two country groups: EMU countries and other industrial countries, on the one hand, and Eastern European and developing countries, on the other hand. The velocity used for each country is the average velocity of the country group to which it belongs. Not using averages would result in implausibly severe divergence of the estimates of the SE among otherwise similar countries. In addition, since velocities of monetary aggregates of most countries exhibit marked time trends, only values of 2007 were used. Finally, monetary aggregates were both adjusted for estimated currency holdings abroad, meaning that velocities are slightly higher than without this adjusmtment.

Source: own calculations.

5 Policy implications

The well publicized statements by some OECD governments about relatively high assumed revenue losses due to the shadow economy and the measures some countries took to reduce it, especially through higher intensity of controls and auditing, and higher punishment for tax and other violations, suggest that previous high estimates of the size of the shadow economy have had their impact.[21] Quite understandably such high perceived revenue losses were interpreted by governments as offering an "easy" way out of fiscal pressure by raising revenues simply through increasing controls of and punishment for shadow economic activity without having to increase taxation or pursue difficult structural reforms including a simplifying comprehensive tax reform. But considering the micro evidence (appendix 4) and scenario 1 above it cannot surprise that the hoped for additional revenues did not materialize. Instead new substantial costs were incurred for the additional controls, auditing, and court proceedings (appendix 4). And these costs usually do not include costs for damages to businesses and people caused by unwarranted prosecutions, which may create new adverse incentives to economic agents. Also not considered are the potential costs due to reduced intrinsic motivation to pay taxes. Hence, contrary to the hoped for effect of higher revenues in the first place, the question is now whether the higher controls and punishment levels have adverse effects?[22]

However, even if the SE is relatively small in most OECD countries, policy-makers may nevertheless want to reduce it. The foregoing results and their evaluation suggest that alternatives to expensive controls and punishment are a comprehensive set of reforms of incentives if reforms influence the perceptions of economic agents:

Political system:

- Introduce elements of direct democracy (e.g. referenda) where participation of taxpayers appears warranted and feasible.
- Strengthen democratic accountability, political stability, the rule of law.

Tax and transfer system:

- Simplify the tax system through introducing a neutral corporate and personal income tax, i.e. an allowance for corporate equity and regarding personal income taxation, a simple consumption tax in the form of an income tax with an allowance for capital income.[23] The reform can be cost neutral through a broadening of the tax base.

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[21] In 2006 Germany's Finance Ministry published the figure of 70 billion Euros (more than 3% of GDP!) of revenue losses due to the SE, which equals 20% of the estimated value of the SE of Schneider (2010) of more than 350 billion Euros. The measures taken by OECD governments against the SE are described, for instance, in Williams et al., 2008, and for Austria and Germany in Feld and Schneider, 2010.

[22] Feld and Larsen (2006) found that there is no statistically significant effect of higher controls and punishment on the SE but given the cited experimental literature on social interactions, fairness and reciprocity effects, it is possible that higher controls and punishment levels, especially if they exceed a certain threshold level, have adverse effects, for instance, on the willingness of economic agents to voluntarily accept a given relatively high tax level.

[23] Note the discussion above of the statistically significant sign of the dummy for interest income taxation (end of chapter 4.1) and that by definition this system reduces or eliminates incentives to export capital to hide it. An income tax is an effective consumption tax and eliminates the intertemporal distortions if either saving or capital income is not taxed. Administration of the tax is easiest and most cost-effective if income, including saving, is taxed first, but the income derived from saving (capital income) is then not taxed. The switch to this system can be done more or less revenue neutral. This system will channel substantial resources currently used to deal with taxation into productive uses. It will substantially reduce the administrative cost. For instance, a simplification of the tax system in Germany could generate administrative savings of above 80000 civil servants in the IRS, which would mean (at an assumed average per capita cost of 60000 Euros) a saving of about 5 billion Euros each year, equivalent to above 0.2% of GDP annually plus the reduced staff of tax advisors. The medium term

- Reduce subsidies where possible. Provide transparent justification for each subsidy granted, best legitimized through referenda.
- Keep transfers under control. Monitor growth of transfers relative to GDP and if necessary limit it.
- Monitor and if necessary limit the size of government.[24]
- Keep taxes on foreign trade, customs duties and import tariffs moderate.
- Monitor the total tax wedge, including social security contributions, and keep it at a moderate level, rather than trying to lower specific taxes such as in Austria, France, and Germany, which lowered the VAT rates for restaurants/hotels or tourism.
- Social security contributions, both, those by employers and those by employees, are also relevant factors and should be stabilized.[25]

Labor market organization:

The statements regarding the labor market organization need to be qualified because among the groups of influences commented here the labor market indicators have a relatively low estimated quantitative impact.

- Unemployment and discouragement of workers are the most important labor market indicators that promote the SE. But programs meant to train, educate and employ unemployed do not statistically significantly help in reducing the SE. Hence, the conclusion would be to improve these programs and/or their organization in order for them to yield the expected results.

- Increasing labor market flexibility tends to reduce the SE, specifically the subcomponents hiring and firing regulations, mandated cost of hiring, minimum wage, and length of military conscription. However, other components of the summary index "labor market flexibility" work in the opposite direction and liberalizing one or several components may have feedback effects on other influences. Hence, measures to increase labor market flexibility need to be carefully considered with due regard to the existing degree of labor market flexibility and other country characteristics.

- Improve incentives particularly during initial phase of unemployment not to misuse unemployment benefits while simultaneously working in the SE.

- In countries with intense labor conflicts reduce them, e.g. through introduction or improvement of an institutionalized mediation process and/or more voluntary or institutionalized regular discussions between labor and management.

- Improve the education, work opportunities and pay for woman because in our analysis the robust positive impact of labor participation on the SE appears to come from female labor participation.

Other institutional and subjective influences:

- Improve evaluation methods of the quality of government with the prime goal to reduce political and other corruption at all government levels.

- Augment the concept of GDP by indicators of life satisfaction. (Note that life satisfaction and happiness tend to reduce the SE, but a high degree of "happiness" is not a sufficient condition for a relatively low SE).

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expansionary economic effects of a tax simplification would be a multiple of these savings due to economic activity undertaken, which is not pursued under current taxation, and higher incentives to work, invest and save. Hence tax revenues would rise.

[24] Adjust, for instance, the number of civil servants to demographic developments under due regard given to potential increases in demand for public services in line with increasing living standards.

[25] Hence, this would support the idea to finance social pensions for which no former payments were made though additional taxes, e.g. on fuel, and cut accordingly social security contributions.

- Improve the quality of the justice system (e.g. raise impartiality and effectiveness of courts as judged by economic agents through improved evaluation methods such as regular surveys of people and comparative evaluations; make state prosecutors independent from political influence).

- Improve the quality of State representatives (e.g. higher incentives to reduce nepotism and favoritism in government decisions, and incentives for increased government effectiveness and quality of information regarding changes in policies and regulations, prevention of diversion of public funds to companies. Possibly all this could be promoted through more elements of direct democracy).

- Improve the quality of enterprise representatives (members of directors and of supervisory boards; e.g. improve effective independence of supervisory boards from board members; improve incentives for managers to adopt long-term horizons; improve independence of those auditing the enterprise; analyze potential problems of "manager capitalism" and based on this possibly strengthen investor and shareholder rights).

- Improve the quality of public goods and services (regular national and international published comparisons, intelligent evaluations by users[26] etc.).

- Reform tax enforcement: a drastically simplified tax system implies reduced incentives for SE activity and tax evasion. Since this system saves extensive administrative costs, resources are available to potentially increase auditing and verification activities of taxpayers.

- Improve punishment rules so that proportions are kept between different kinds of offenses and no adverse effects are created. Consider that shadow economic activity and tax evasion have several different motives. And consider whether other means can be more effective in achieving desired results such as the proposed tax system reform.

- Coordinate the policy with EU partner countries and internationally, so as to reinforce the reform impact and to avoid contradictions. Since, for instance, new international distortions would be created if the proposed tax system reform would be implemented by one country alone, a coordinated tax system reform would be a best solution.

Moral suasion policy to increase the impact on perceptions:

- Complement the reforms by a moral suasion policy through modern information channels in the form of an education to pay taxes voluntarily by increasing transparency about essential government services and their quality. Based on the evidence for fairness effects, reciprocity, cooperative behavior etc., this could also be a relevant element in an overall strategy.

6 Concluding remarks

Cross-section analysis can be particularly useful when the emphasis is on long-term effects since differences in countries today reflect long term developments and the results are not influenced by the time dimension. This may justify use of our data set of period averages covering less than two decades with gaps. Admittedly, this limits the choice of specifications and the possibilities to test conditional hypotheses. However, the results obtained include a first time estimate of the organized crime related shadow economy and estimated consistently plausible effects of a large array of influences on the SE. Noteworthy, many of them appear to be quantitatively at least as relevant as the standard causes of unofficial activity (the tax and regulatory burden).

[26] Introduce intelligent evaluation, for instance, by systematically collecting and using valuable information such as that of the reasons for parents to take their child from a school and choose another one.

This indirectly confirms the hypothesis for the effect of the standard causes on the SE to be conditional: a relatively high tax level may be associated with a relatively small SE depending on other influences. Most of these other relevant influences could well be affected by governments so there appears ample room for governments to influence the SE by other means than through taxation, the administrative burden, labor market regulation, and/or controls and punishment. Many of the influences found to be highly robust confirm new theoretical and experimental evidence on pro-social behavior.

We also find that the relatively large estimated sizes of the SE on the basis of macro models (currency models or Mimic) stem from using a relatively high assumed income velocity of the currency used in the SE.[27] But a relatively low velocity can be much better defended, since the role of currency in income generation is small and continues to diminish. And assuming a relatively low income velocity, such as that of M2, yields estimates of the SE which are well in line with the micro evidence. Only then are macro models and the micro evidence consistent approaches suggesting the SE to be no larger than a few percent of official GDP. However, estimates of the SE are sensitive to the unavoidable velocity assumption and thus such estimates on the basis of currency demand or Mimic models can only be indicative.

The often published relatively high estimates of the SE on the basis of macro models have had their effect on governments such that they believed and expected to raise enormous additional revenues through increasing both controls and punishment levels so as to reduce the SE. These measures included higher punishment levels, expensive additional controls of economic activity, of financial flows and even of ownership of currency, and special tax incentives to increase tax compliance making the tax system even more complex. In addition, the measures were implemented without international coordination. If the assumption is correct that the size of the SE in an average industrial country is a few percent of GDP these measures could not have raised the expected enormous revenues. And indeed, they yielded miniscule revenues but caused sizable new expenditures and potential other intangible costs, which have not yet been analyzed. But the divergence between expectations and facts does not appear to have led to conclusions.

Irrespective of the true size of the SE, the results may suggest a catalogue of potential reform measures for influencing and reducing it as an alternative to the policies some OECD countries have chosen such as higher punishment levels, expensive additional controls of economic activity and unfortunately even more complex tax systems. Ideally, measures should be coordinated internationally and in the EU. They could be effective not only in promoting growth of official economic activity but also in freeing some government resources.

[27] As stated above, Mimic models yield an index whose transformation into actual estimated ratios of the SE to GDP requires using other such estimated ratios, which are usually taken from currency models without making explicit the assumed velocity. Hence, their results - as those of currency models - depend crucially on the velocity assumption.

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Appendices

Appendix 1: Indicators and sources

Category	Sub-Index	Source	Years/ Countries	Variable name
1 Constitutional system	- Democratic system	Polity IV	since 91, 34	democ
	- Combined Polity Score	Polity IV	since 91, 34	polity
	- Regime Durability	Polity IV	since 91, 34	durable
	- Executive Constraints	Polity IV	since 91, 34	xconst
	- Regulation of Participation	Polity IV	since 91, 34	parreg
	- Having democratic system in country is good	WVS	since 95, gaps, 38	e117
	- Rule of Law	World Bank, Gov. Indic.	since 96, gaps, 38	wbgl
	- Voice and Accountability	World Bank, Gov. Indic.	since 96, gaps, 38	wbgv
	- Political Stability & Absence of Violence/Terrorism	World Bank, Gov. Indic.	since 96, gaps, 38	wbgp
	Elements of direct democracy:			
	- Direct democracy Index	Fiorini & Ricciuti (2007)	time invariant	ddi
	- Political action signing a petition (have done)	WVS	since 91, gaps, 38	e025
	- Country is run for all people	WVS	since 91, gaps, 24	e128
	- Democratic accountability	ICRG	since 91, gaps, 38	icda
2 Tax and social security burden	*Social security burden:*			
	- Tax and social security burden (% of GDP)	OECD	since 91, 28	tssgdp
	- Employees' social security contributions (average rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children)	OECD	since 91, 30	sscafa
	- Social security contrib. labor (% of GDP)	OECD	since 91, 28	ssclgdp
	- Social security contrib. employers (% of GDP)	OECD	since 91, 28	ssccgdp
	Tax burden:			
	- Total tax revenue (% of GDP)	OECD	since 91.31	ttrgdp
	- Total receipts general government (% of GDP)	OECD	since 91, 28	rggdp
	- Total corporate tax rate (% of profit)	IFC	06-07, 36	dbe3
	- Fiscal freedom (inc. + corp. tax rate + total tax ev./GDP)	Heritage	since 1995	hfisf
	- Indirect Taxes (% of GDP)	OECD	since 91, 28	tingdp
	- Direct Taxes (% of GDP) - total	OECD	since 91, 28	tdgdp

	- personal	OECD	since 91, 25	tdhhgdp
	- business	OECD	since 91, 25	tdbgdp
	- Taxes on income, profits and capital gains (% of GDP)	OECD	since91, 30	tipcgdp
	- Personal income tax rate (average of 6 earnings levels and 5 family types, %)	OECD	since 91, 30	itr
	- Personal income tax rate (average rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children)	OECD	since 91, 30	itrafa
	- Taxes on i., p. & c.g. of individuals (% of GDP)	OECD	since 91, 30	tiipcgdp
	- Taxes on capital gains of individuals (% of GDP)	OECD	since 91, 27	ticgdp
	- Corporate taxes on income, profit & c.g. (% of GDP)	OECD	since 91, 29	tcipcgdp
	- Property taxes (% of GDP)	OECD	since 91, 30	tpgdp
	- Taxes on financial and capital transact. (% of GDP)	OECD	since 91, 30	tfgdp
	- Taxes on goods & services	OECD	since 91, 30	tgsgdp
	- VAT and sales taxes (% of GDP)	OECD	since 91, 30	tvatsgdp
	- Taxes on international trade (% of GDP)	Fraser	since 91, gaps, 38	f4a
	- Customs and import duties (% of GDP)	OECD	since 91, 30	tcigdp
Optimal taxation	- Tax wedge incl. soc.sec. (aver. of all income and family types; aver. rate in %)	OECD	since 91, 30	tw
	- Tax wedge (average rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children)	OECD	since 91, 30	twafa
	- Tax wedge (marginal rate; average of all income and family types; rate in %)	OECD	since 91, 30	twmra
	- Tax wedge (marginal rate; two-earner married couple, one at 100% of average earnings and the other at 67 %, 2 children)	OECD	since 91, 30	twmfa
	- Tax wedge (marginal rate; single person at 167% of av. earnings, no child, in %)	OECD	since 91, 30	twmrs
	- Taxes less subsidies on products (% of GDP)	OECD	since 91, 34	tggdp
	- Taxes on production and imports less subsidies (% of GDP)	OECD	since 91, 33	tpigdp
	- Top marginal tax rate			
	- personal	OECD	since 91, 36	hmti
	- corporate	OECD	since 91, 37	hmtc
	- Top marginal Income tax	Fraser	since 91,	f1b

	rate (and income threshold at which it applies)		gaps, 38	
	- Top marginal income and payroll tax rate (and income threshold at which it applies)	Fraser	since 91, 36	f1c
	- Taxation of nominal interest income (dummy)	Dummy =1, if tax rate at source > 20%	since 91-07, 38	dit
	- Government size	Heritage	since 95, gaps, 38	hgs
	- Government size	Fraser	since 91, gaps, 38	f1d
	- Subsidies (% of GDP)	OECD	since 91, 28	subgdp
	- Subsidies and other transfers (% of expense)	WDI	since 95, 36	subtrexp
	- Transfers & subsidies (% of GDP)	Fraser	since 91, gaps, 38	f1a
	- Extent and effect of taxation	WEF	since 03, 38	wef603
	Complexity of tax system:			
	- Tax payments (number)	WDI	since 04, 36	tpn
	- Tax payments (number)	IFC	since 06, 36	dbe1
	- Paying taxes (time hours)	IFC	since 06, 36	dbe2
	- Cost of tax compliance for business	Fraser	since 05, 36	f5o
	- Compliance cost of importing and exporting	Fraser	since 00, 38	f4c
3 Administrative burden	- Business regulations	Fraser	since 95, gaps, 38	f5p
	- Administrative requirements	Fraser	since 00, gaps, 38	f5k
	- Burden of government regulation	WEF	since 98, gaps 38	wef107
	- Regulatory quality	World Bank, Gov. Ind.	since 96, gaps 38	wbgr
	- Bureaucratic quality	ICRG	since 91-05,	icbq
	- Quality of regulatory standards	WEF	since 00, gaps, 38	wef904
	- Bureaucracy costs	Fraser	since 95, gaps, 38	f5l
	- Starting a business	Fraser	since 95, gaps, 38	f5m
	- Extra payments/bribes	Fraser	since 95, gaps, 38	f5n
	- Business Freedom	Heritage	since 95, gaps, 38	hbf
	- Extent of bureaucratic red tape (%age of work time)	WEF	since 00, gaps, 38	wef610
	- No. procedures start busin.	WEF	since 04, 37	wef604
	- Time req. to start a business	WEF	since 04, 36	wef605
	- No. of procedures to resolve a dispute	WEF	since 01, 32	wef806

	Trade related:			
	- Hidden trade barriers	WEF	since 2000, gaps, 38	wef210
	- Non-tariff trade barriers	Fraser	since 95, gaps, 38	f4b
	- Regulatory Trade Barriers	Fraser	since 95, gaps, 38	f4d
	- Trade freedom	Heritage	since 95, gaps, 38	htf
4 Quality of administration and justice system	**Quality of administration:**			
	- Government Effectiveness	World Bank, Gov. Indic.	since 96, gaps, 38	wbgg
	- Control of Corruption	World Bank, Gov. Indic.	since 96, gaps, 38	wbgc
	- Efficiency of legal framework	WEF	since 01, gaps, 38	wef602
	- Irreg. paym. in public util.	WEF	since 00, gaps, 38	wef123
	- Irreg. paym. in tax collect.	WEF	since 00, gaps, 38	wef124
	- Irreg. paym. in publ. contracts	WEF	since 00, gaps, 38	wef125
	Quality of justice system:			
	- Irregular payments in judicial decisions	WEF	since 01, gaps, 38	wef126
	- Judicial independence	Fraser	since 95, gaps, 38	f2a
	- Judicial independence	WEF	since 97, gaps, 38	wef601
	- Integrity of the legal system	Fraser	since 95, gaps, 38	f2d
	- Impartial courts	Fraser	since 95, gaps, 38	f2b
	- Bribes for influencing laws, policies, regulations, decrees	WEF	since 01, gaps, 38	wef127
	- Confidence in justice system	WVS	since 91, gaps, 38	e085
5 Economic Institutions	**Property rights and legal formalism:**			
	- Protection of property rights	Fraser, WEF, Heritage	95, 00-06, 38 since 99, gaps, 38 since 95, 38	f2c wef611 hpr
	- Regulation of entry (=contract law, legal formalism)	IFC and Djankovic et al. (2002)	since 04, 35	dba3
	- Number of legal procedures to collect an unpaid check (contract law, legal formalism)	IFC and Djankovic et al. (2002)	04-07, 35	dbf1
	- Enforcing contracts (days)	IFC	04-07, 33	dbf2
	- Enforcing contracts (cost)	IFC	04-07, 35 since 05, 35	dbf3
	- Legal enforcement contracts	Fraser	since 96, gaps, 35	f2e
	- Intellectual property rights	WEF	since 01,	wef607

	- Auditing & Reporting Stand.	WEF	gaps, 38 since 01, gaps, 38	wef608
	- Investor protection index	IFC	06-07, 36	dbd4
	- Disclosure index	IFC	06-07, 36	dbd2
	- Director Liability index	IFC	06-07, 36	dbd1
	- Intensity of local competition	WEF	since 00, gaps, 38	wef801
		Heritage	since 95, 38	hif
	- Investment Freedom	Heritage	since 95, 38	hmf
	- Monetary Freedom	Heritage	since 95, 38	hfinf
	- Financial Freedom			
	Labor market:			
	Overall indices:			
	- Labor freedom	Heritage	since 05, 38	hlf
	- Labor market rigidity index	Rama, Artecona (2002)	91-99, 29	labri
	- Labor market regulations	Fraser	since 91, gaps, 38	f5j
	Participation rates:			
	- Labor force participation rate	OECD and	91-07, 30	lfpr
		Rama, Artecona (2002)	91-99, 36	lfrall
	- Female participation rate	Rama, Artecona (2002)	91-99, 36	lfrfem
	- Male participation rate	Rama, Artecona (2002)	91-99, 36	lfrmle
	- Employment outside agriculture that does not contribute to Social Security	?	?	?
	Hiring and firing:			
	- Hiring and firing practices	WEF	since 96, gaps, 38	wef612
	- Hiring and firing regulations	Fraser	91-06,gaps, 38	f5g
	- Mandated cost of worker dismissal	Fraser	since 05, 36	f5i
	Wage determination:			
	- Flexibility of wage Determination	WEF	since 01, gaps, 38	wef613
	- Centralized collective Bargaining	Fraser	since 91, gaps, 38	f5h
	- Coverage of collective bargaining agreements	Rama, Artecona (2002)	91-99, 23	tucvge
	Unemployment:			
	- Unemployment rate	OECD	91-99, gaps, 38	ur
	- Long term unemployment (% of labor force)	OECD	91-99, gaps, 30	url
	- Female unemployment, (% of Labor Force)	Rama, Artecona (2002)	91-99, 23	unrfem
	- Male unemployment, (% of Labor Force)	Rama, Artecona (2002)	91-99, 23	unrmle
	- Discouraged workers (% of labor force)	OECD	1991-05, 17	dwlf
	- male		00-07, 16	dwwlf
	- female		00-07, 17	dwmlf
	- Non-employment rate: (= 15 - 65 years old - employment)/ 15 – 65 y.o.)	OECD	91-05, 30	ner

	- Vulnerable employment (% of total employment)	WDI	gaps, 28	empv
	Remuneration:			
	- Minimum wage relative to average value added per worker	Fraser	since 95, 36	f5f
	- Degree of pay related to worker productivity	WEF	since 99, 38	wef1021
	Participation rights:			
	- Employee's participation rights	ETUI	91-07, 38	pi
	Unionization:			
	- Trade Union Members (% of employees)	OECD	91-01, 30	tumsr
	- Total trade union membership	Rama, Artecona (2002)	91-99, 32	tummbr
	Replacement rates:			
	- Replacement Rate for long term unemployment (average net rate in %)	OECD	since 01, 29	nrrl
	- Replacement Rate for initial phase of unemployment (average net rate in %)	OECD	since 01, 29	nrrin
	Labor market programs:			
	- Active labor market program expenditures (% of GDP)	OECD	since 91, 29	pubexp
	- Education/training expenditures for unemployed (% of GDP)	OECD	since 91, 29	train
	Strikes and lock-outs:			
	- Number per year	Rama, Artecona (2002)	91-99, 30	stknbr
	- Workdays lost	Rama, Artecona (2002)	91-99, 30	stkhrs
	Tax enforcement:			
	a) Probability of tax fraud detection			
	- Tax administration expenditure (in % of GDP)	OECD	since 05, 23	taxadmgdp
	- Tax administration staff per taxpayer	OECD	since 03, 33	taxstp
	- Number of tax auditors per taxpayer, in o/oo	OECD	since 03, 33	taxaup
	- Verification activities per taxpayer	OECD	since 05, 31	taxverp
	- Coverage (number of completed actions/taxpayers)	OECD	2007, 26	taxcov
	- Number of citizens per tax administration staff	OECD	since 03, 38	taxpc
	- Social security tax collection rate	?	?	?
	- Police per 100th. population	Eurostat	since 97, 35	ci
	b) Punishment			
	- Number prisoners (per 100 th. population)	Eurostat	since 93, 36	ch
	- Penalty tax rate	?	?	?

	- Fine rate	?	?	?
	- Sentencing rate	?	?	?
	c) Risk aversion of tax payers to withhold taxes	?	?	?
	Educational system			
	- Educational attainment	?	?	?
	- Public spending on education, total (% of GDP),	WDI	91-2004, 38	edugdp
	- Pupil-teacher ratio, primary	WDI	96-04, 37	ptrp
	- Pupil-teacher ratio, second.	WDI	99-05, 35	ptrs
	- School enrollment, secondary (% gross)	WDI	98-05, 38	ses
	- School enrollment, tertiary (% gross)	WDI	99-05, 37	set
	Innovation potential			
	- ICT expend. (% of GDP)	WDI	since 00, gaps, 31	itgdp
	- R&D. exp. (% of GDP)	WDI	since 96, gaps, 38	rdgdp
	- R&D. exp. (% of GNI)	WEF	since 96, gaps, 35	wef314
	- Technological sophistication	WEF	since 96, gaps, 37	wef301
	- Company Spending on R&D	WEF	since 97, gaps, 38	wef308
	- Univers./Industry collabor.	WEF	since 00, gaps, 38	wef309
6 Values/Moral	*Social Capital, social norms:*			
	(e.g. degree of organizational membership of population)	Putnam ?	?	?
	- Trust other people in country	WVS	since 91, gaps, 32	g007b
	- Accepting a bribe justifiable	WVS	since 91, gaps, 38	f117b
	- Justifiable: claiming govern-ment benefits to which you are not entitled	WVS	since 91, gaps, 38	f114
	- Justifiable: avoiding fare on public transport	WVS	since 91, gaps, 38	f115b
	- Impact of nepotism	WEF	since 05, gaps, 38	wef129
	Tax moral:			
	- Cheating on taxes justifiable	WVS	since 91, gaps, 38	f116b
	Social aspects:			
	- Family important in life	WVS	since 95, gaps, 38	a001
	- Spend time with friends	WVS	since 00, gaps, 33	a058
	- Belong to labor unions	WVS	since 91, gaps, 35	a067
	- Belong to political parties	WVS	since 91, gaps, 35	a068
	- Belong to none	WVS	since 91, gaps, 33	a080

	- Income equality (should be made more equal)	WVS	since 95, gaps, 37	e035
	- Importance of eliminating big income inequalities	WVS	since 00, gaps, 28	e146
	- Govt. should take more responsibility	WVS	since 95, gaps, 38	e037
	- Govt. should be more open to public	WVS	since 91, gaps, 30	e058
	- Govt. should allow more freedom for individuals	WVS	since 91, gaps, 29	e059
	- Confidence in churches	WVS	since 91, gaps, 38	e069
	Religion:			
	- Believe in god	WVS	since 91, gaps, 36	f050
	- Importance of god in life	WVS	since 91, gaps, 38	f063
	- Religious fraction in population	La Porta (1999)	time inva-riant	rel2
	- Religion fractionalization	Alesina et al. (2003)	time inva-riant	rel1
	- Spend time with people at church, mosque, synagogue	WVS	since 00, gaps, 29	a060
	- Spend time with people at sport, culture, commun. org.	WVS	since 00, gaps, 31	a061
	- Belong to religious org.	WVS	since 91, gaps, 35	a065
	Corruption:			
	- Corruption	TI	since 95, gaps, 38	copi
	- Corruption	ICRG	s. 91-05, 38	icco
	- Extent of Political corruption	WVS	since 95, gaps, 23	e196
	- Impact of business costs of corruption	WEF	since 00, gaps, 38	wef128
	- Reliability of bribes	WEF	only 01, 35	wef709
	- Freedom from Corruption	Heritage	since 95, 38	hcp
7 Other influences and subjective factors	**Quantity and quality of public goods provision:**			
	- Quality of public schools	WEF	since 00, gaps, 38	wef508
	- Confidence in educ. system	WVS	since 03, gaps, 34	e071
	- Overall infrastructure quality	WEF	since 96, gaps, 38	wef201
	- Reliability of police services	WEF	since 01, gaps, 38	wef109
	- Irregular payments in public utilities	WEF	since 00, gaps, 38	wef123
	- Irregular payments in exports & imports	WEF	since 00, gaps, 38	wef701
	- Differences in quality of healthcare	WEF	since 1999, gaps, 36	wef509
	- Confidence in soc.sec.syst.	WVS	since 91, gaps, 34	e077b
	- Confidence in Govt.	WVS	since 91,	e079

	- Confidence in Parliament	WVS	gaps, 29 since 91,	e075
	- Confidence in Polit.Parties	WVS	gaps, 38 since 91,	e080
			gaps, 29	
	Efficiency of public goods provision:			
	- Wastefulness of government spending	WEF	since 03,	wef106
	- Efficiency of legal framework	WEF	gaps, 38 since 01,	wef602
			gaps, 38	
	Quality of State representatives:			
	- Competence of public officials rel. to priv. sector	WEF	since 99,	wef606
	- Satisfaction with people in national office	WVS	gaps, 36 since 95,	e125b
	- Favoritism in decisions of government officials	WEF	gaps, 24 since 00,	wef609
	- Diversion of public funds to companies etc.	WEF	gaps, 38 since 01,	wef710
	- Public trust of politicians	WEF	gaps, 38 since 98,	wef104
	- Bribes for influencing laws, policies, regulations, or decrees	WEF	gaps, 38 since 01,	wef127
	- Prevalence of illegal political donations	WEF	gaps, 38 since 01,	wef713
	- Effectiveness of law-making bodies	WEF	gaps, 38 since 01,	wef116
	- Quality of information regar. changes in policies & regul.	WEF	gaps, 38 since 01,	wef117
	- Policy consequences of legal political donations	WEF	gaps, 38 since 01,	wef714
	- Misuse of legal political donations	WEF	gaps, 38 since 01,	wef715
			gaps, 35	
	Quality of enterprise representatives:			
	- Efficacy of executive boards	?	?	?
	- Confidence in major companies	WVS	since 91,	e081
	- Ethical behavior of firms	WEF	gaps, 38 since 01,	wef1005
	- Willingness to delegate authority	WEF	gaps, 38 since 00,	wef1013
	- Extent of staff training	WEF	gaps, 38 since 00,	wef1012
	- Cooperation in labor-employer relations	WEF	gaps, 38 since 00,	wef1020
	- Efficacy of supervisory boards	WEF	gaps, 38 since 96,	wef113
			gaps, 38	
	- Socioeconomic conditions	ICRG	since 91-05, 38	icsec
	- Confidence in regional organizations (e.g. EU, Nafta)	WVS	since1991, gaps, 32	e086

	Decentralization			
	- Decentralization of economic policymaking	WEF	since 01, gaps, 38	wef120
	- Regulatory obstacles to business (local vs. federal)	WEF	since 01, gaps, 35	wef209
	State of cluster development (low vs. high)	WEF	since 00, gaps, 38	wef906
	Crime:			
	- Cost of crime for business	WEF	since 01, gaps, 38	wef110
	- Organized crime	WEF	since 96, gaps, 38	wef111
	- "Serious" crime (per 100th. pop.):			
	- Homicide	Eurostat	since 93, gaps, 36	ce
	- Assault	Eurostat	since 93, gaps, 35	cd
	- Drug trafficking	Eurostat	since 95, gaps, 35	cf
	- "Light" crime (per 100th. pop.):			
	- Auto theft	Eurostat	since 93, gaps, 34	ca
	- Burglary	Eurostat	since 93, gaps, 36	cb
	- Robbery	Eurostat	since 93, gaps, 36	cc
	- Total acts of crime	Eurostat	since 95, gaps, 36	cg
	- Indicator of typical informal activity, e.g. illegal employment in construction	?	?	?
	Prisoners per 100 th. pop.	Eurostat	since 93, gaps, 36	ch
	Police per 100 th. pop.	Eurostat	since 95, gaps, 35	ci
	Indicator for drug trafficking	UNDC: indicator has poor quality	since 96, gaps, 35	drugtpop
	Feelings and Expectations:			
	- Feeling of happiness	WVS	since 95, gaps, 38	a008
	- Satisfaction with financial situation of household	WVS	since 95, gaps, 36	c006
	- Satisfaction with your life	WVS	since 95, gaps, 38	a170
	- Recession expectations	WEF	since 96, gaps, 38	wef307
	- Interest in politics	WVS	since 95, gaps, 38	e023
	- Satisfaction with the way democracy develops	WVS	since 00, gaps, 33	e110
	- In democracy, the economic system runs badly	WVS	since 95, gaps, 37	e120b
	- Democracies are indecisive	WVS	since 95,	e121b

	and have too much squabbling		gaps, 37	
	- Democracies aren´t good at maintaining order	WVS	since 95, gaps, 37	e122b
	- Democracy may have problems but is better	WVS	since 95, gaps, 37	e123b
	Globalization:			
	Total index	KOF	since91, gaps, 38	glot
	Economic globalization	KOF	since 91, gaps, 38	globe
	Inequality of income:			
	- Gini	WDI	since 00, gaps, 38	ginia, gini
	- Richest 10% to poorest 10%	UN, HDR and WDI	since 96, 35	rich10
	- Richest 20%to poorest 20%	WDI	since 98, 35	rich20
	Gender:			
	- Proportion of seats held by women in national parliament (%)	WDI	since 97, gaps, 38	wp
	- Gender empowerment measure	UN (HDR)	since 95, gaps, 38	gem
	- Female labor participation rate	Rama & Artecona (2002)	91-99, 36	lfrfem
	- Male labor participation rate	Rama & Artecona (2002)	91-99, 36	lfrmle
	- Female unemployment (% of LF)	Rama & Artecona (2002)	91-99, 31	unrfem
	- Male unemployment (% of LF)	Rama & Artecona (2002)	91-99, 31	unrmle
	Aging:			
	- Dependents to working-age persons	WDI	91-06, 38	age
	- Population ages 65 and above (% of total)	WDI	91-06, 38	aged
	Population structure:			
	Urban population (% of total)	WDI	91-06, 38	up
	Financial secrecy			
	Opacity score of the financial secrecy index	Tax Justice Network	2009	fsi
	Bank secrecy dummy (1 = bank secrecy law is relatively effective; 0 = no bank secrecy law or not effective)	own	91-07	banksec
	Credit indicators:			
	- Access to credit	WEF	since 98, gaps, 38	wef205
	- Domestic credit (% of GDP)	WDI	since 91, gaps, 38	dcgdp
	- Credit market regulations	Fraser	since 91, gaps, 38	f5e
	- Venture capital availability	WEF	since 2000, gaps, 38	wef206
	- Credits cards per capita	Visa	since 91-02,	ccpc

	(Visa) - Standard deviation of inflation	Fraser	gaps, 30 since 91, gaps, 38	f3a
Overall institutional quality index	- Institutions Climate Index (24 OECD countries)	Theo Eicher, Univ. of. Washington & Ifo	since 94, gaps, 24	ici
	- Human Development Index	UN HDR	since 92-05, 38	hdi
	- Economic Freedom	Fraser	since 91, gaps, 38	fi
	- Economic Freedom	Heritage	since 95, 38	hef
	- Business Freedom	Heritage	since 95, 38	hbf
Indicators of Shadow economic activity	- Money in cash holdings relative to M2 or per capita	IFS, ECB and own estimates	91-07, 38	capifs + capecb
	- Estimates of unofficial GDP (% of official GDP)	Schneider (2007)	since 91, 35	sesch
	- Informal sector	WEF	since 00, gaps, 38	wef616
	- Cheating on taxes justifiable	WVS	since 91, gaps, 38	f116b
	- Extra payments/bribes	Fraser	since 95, gaps, 38	f5n
	- Employment in unofficial economy in the capital of the country as % of official labor	Global Urban Indicators Database 2000	93 and 98, 4	infsec
	- Share of sales reported for tax purposes	World Bank and EBRD (BEEP surveys)	00, 02, 05 (27 transition countries & Turkey)	
Potential Instruments	- Legal origin of country (British, French, German, Scandinavian, Socialistic)	La Porta et al. (1998)	since 91, gaps, 38	dle, dlf, dlg, dlsc, dlso
	- Average temperature		time invariant	
	- Average cloudiness			
	- Latitude	Alesina et al. (2003)		lat
	- Religious fractionalization	Alesina et al. (2003)		rel1
	- Ethnic fractionalization index	Alesina et al. (2003)		eth1
	- Ethnic fractionalization index	Roeder (2001), weber.ucsd.edu/proeder		eth2
	- Language fractionalization	Alesina et al. (2003)		language

Notes:

In the forth column (years) an “s.” denotes “since” followed by the last two digits of the first year for which data area available for at least one country. In brackets the number of missing countries is indicated abbreviated by c.m., i.e. “countries missing”, e.g. “s. 05 (7c.m.). meaning first year with observations is 2005 where 7 countries are missing.

gaps y. = there are gaps regarding some years but not regarding countries.

Source: own compilation.

Data sources:

Djankovic et al. (2002), The Regulation of Entry, Quarterly Journal of Economics 117 (1), 1- 37.

Dreher, A. (2006), Does globalization affect growth? Evidence from a new index of globalization, Applied Economics 38 (10), 1091-1110

ECB: European Central Bank, Frankfurt am Main.

European Commission (2007), Euro cash: Five and familiar, European Economic News 5, January 2007, http://ec.europa.eu/economy_finance/een/005/article_4324_en.htm.

ETUI: European Trade Union Institute, Brussels, www.etui.org.

Fiorino, N., and R. Ricciuti (2007), Determinants of direct democracy, Cesifo Working Paper No. 2035, Munich.

Fraser: The Fraser Institute (2008), Annual Report 2008. Vancouver, Canada, www.freetheworld.com. Higher indicator values indicate better quality. For the period 1991-2000 there are only 2 observations available for 1991 and 1995.
Although regarding some variables the original source is the World Economic Forum questionnaire, the respective variables were included because the available time period started earlier.

Heritage Foundation (2008), The index of economic freedom, Washington D.C., (http://www.heritage.org/index). 10 Economic Freedoms and subindices are defined. Higher indicator values indicate better quality. Indicator values are available starting mostly from 1995 or 1996. The indicator “Fiscal Freedom” includes the income and corporate tax rate and tax revenue as a percentage of GDP.

IFS: International Monetary Fund, International Financial Statistics, Washington D.C.

IFC: International Finance Corporation and World Bank, Doing Business Indicators, www.doingbusiness.org. Depending on the subject higher indicator values indicate a better or worse situation.

IFO: Institut für Wirtschaftsforschung, Munich. Institutional Climate Index: Higher indicator values indicate better quality.

ICRG: International Country Risk Guide, Political Risk Services Group (PRS), http://www.prsgroup.com/ICRG_Methodology.aspx. Higher indicator values indicate better conditions and quality.

KOF: Konjunkturforschungsstelle, Institut für Konjunkturforschung, Zürich. Globalization index: Higher values indicate higher degree of globalization.

Polity IV: University of Maryland, Center for Systemic Peace. Political Regime Characteristics and Transitions, 1800-2008. http://www.systemicpeace.org/polity/polity4.htm. Higher values indicate higher democratic quality of the political system.
The authority characteristics of states are coded for purposes of comparative, quantitative analysis. The "Polity Score" captures this regime authority spectrum on a 21-point scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). The Polity scheme consists of six component measures that record key qualities of executive recruitment, constraints on executive authority, and political competition. It also records changes in the institutionalized qualities of governing authority. The Polity data include information only on the institutions of the central government and on political

groups acting, or reacting, within the scope of that authority. It does not include consideration of groups and territories that are actively removed from that authority (i.e., separatists or "fragments").

Rama, M., and R. Artecona (2002), A Database of Labor Market Indicators across Countries. Manuscript World Bank, Washington D.C, containing detailed indicators for 121 countries based on the period 1990-1999. The authors constructed two 5-year averages (for 1990-1994- and 1995-1999), i.e. the index has 2 observations. Labor market rigidity index: Higher values indicate higher rigidity.

Schneider, F. (2007), Shadow Economies and Corruption all over the World: New Estimates for 145 Countries, Economics: The Open Access, Open Assessment, E-journal, Number 2007-9, www.economics-ejournal.org/economics/journalarticles/2007-9.

Tax Justice Network (2009), The financial secrecy index for 2009, www.financialsecrecy index.com.

TI: Transparency International (2009), Corruption Perception Index, Berlin. www.transparency.org. Higher indicator values indicate less corruption.

UN (HDR): United Nations, Human Development Report, New York, http://hdr.undp.org/en/. Higher indicator values indicate higher development level.

WDI: World Bank, World Development Indicators, Washington D.C.

World Bank (2007), Indicators of governance, Washington D.C.: Higher indicator values indicate better quality or better results. http//info.worldbank.org/governance/wgi/ resources.htm.

World Bank and EBRD, Business Environment Survey (BEEPS), http://www.ebrd.com/ country/sector/econo/surveys/beeps.htm.

WEF: World Economic Forum, Global Competitiveness Report, various issues, www.weforum.org. A scale of 1-7 is generally used. Higher indicator values indicate better quality or better results. For example, the indicator wef124 “irregular payments in tax collection” with a scale of 1-7 achieves its maximum if such payments never occur (high quality), and a minimum if they are common (low quality).
Some exceptions exist when “raw data” is provided (e.g. number of procedures or time required to start a business wef604, wef605; extent of bureaucratic red tape, wef610) or when respondents are asked to identify the location of a problem where the scale of 1-7 indicates the poles of the location of the problem (e.g. regulatory obstacles to business, local or federal government, wef209).

WVS: World Value Survey (2007), “Human beliefs and values”, (R. Inglehart, M. Basanez, J. Diez-Medrano, L. Halman and R. Luijkx, eds.), available at: http://www.worldvaluessurvey. org. Ronald Inglehart, Chairman, Institute for Social Research, University of Michigan, Ann Arbor, Michigan, USA.
The index rises if a higher percentage of respondents agrees or strongly agrees with the respective statement. During the period 1991-2007 WVS has as its maximum three observations due to three waves in this period, i.e. 1991, 1995, and 2000. For many countries and regarding many questions less than these three waves are available. For several countries and several questions there was no survey performed. In the three waves the respondents were asked whether they agree strongly, agree, disagree or strongly disagree with a particular statement. We recoded this data by calculating the percentage of answers that agreed with the first two categories. Hence, this index rises if a higher percentage agrees or strongly agrees with the respective statement.

Appendix 2: Data on currency holdings, currency holdings abroad and other monetary aggregates

The two primary sources used in collecting the data on monetary aggregates were International Financial Statistics of the International Monetary Fund (IFS) and regarding EMU countries the monetary statistics of the European Central Bank (ECB). Since the inception of the EMU monetary aggregates for EMU member countries are not published by the IFS but estimates are available from the ECB.

To consider the issue of currency holdings outside the respective jurisdiction of the sample countries, estimates of these holdings were considered. Following the literature there are mainly two currencies affected by currency holdings abroad, which are the US Dollar and the Euro (Rogoff, 1998, Seitz, 1995, Porter and Judson, 1996). For these two currencies adjustments for estimated currency holdings abroad have been made based on available estimates. Since for the USA the estimates for the foreign share of currency range between about 50 to 70 percent we used the mid range figure of 60 percent. Regarding the Euro there are two estimates available: One for the former DM holdings abroad from the year 1995 performed by the Bundesbank (Seitz, 1995) and one by the ECB based among others on net shipments of Euro notes outside the Euro area (Fischer et al., 2004). For 2006 the ECB estimated that between 10 to 20 percent of the total value of euro currency in circulation was held outside the euro area (European Commission, 2007). The mid-range of this estimate, i.e. 15 percent (about 78.6 billion Euros in 2006) is very close to the interpolated former estimate of currency holdings abroad by the Bundesbank: Assuming that the 1994 estimated DM currency holdings abroad increase by the estimated average growth of DM currency holdings abroad on average during 1975-1994 (both converted into Euros) yields 78 billion Euros in 2006. The estimated total Euro currency holdings abroad were allocated to the individual EMU countries using the shares of EMU countries' currency in circulation.

Appendix 3: The assumption of income velocity of currency used in the SE

The assumed value of income velocity of currency is crucial because the estimates of the SE are directly proportional and thus extremely sensitive to it.

Currency velocity in the official economy is obtained by dividing official GDP by currency in circulation (velocity = official GDP/ currency).
Previous studies estimating the size of the SE argued that since the velocity of currency in the SE is difficult to estimate and as long as there is no better knowledge about velocity of currency in general, one has to accept the assumption of "equal" currency velocity in the official and unofficial economy (e.g. Schneider, 1986, p. 665). Schneider (2007, p. 31) argues that one has to accept the assumption of "equal" money velocity in both sectors. But it is unclear what "money" means, i.e. whether it is currency or which monetary aggregate.

For the following reasons this assumption needs to be discussed:

- Official GDP always includes some estimate of unofficial GDP (e.g. unofficial production in agriculture is included in official GDP, because agricultural GDP is calculated by multiplying all farmland by average price, e.g. Braakmann (2004)). Hence, if this estimate of unofficial activity is deducted from official GDP and the resulting "official transactions GDP" divided by currency, we obtain a corrected official velocity figure smaller than official velocity.

- Most importantly, however, and stressed by few authors such Breusch (2005b, p. 33, and Hill, 2002), the assumption of equality ignores that currency represents a very small part in the money supply of the official economy: For instance, currency to M2 ratios in 2007 in the industrial countries of our sample stood between merely 1 percent in Iceland and 11.2 percent in Italy! Regarding the

developing countries in our sample this ratio in 2007 stood between 6.6 percent in Turkey and 17.1 percent in Bulgaria. Hence, using the official GDP velocity of currency appears to be an extreme assumption which vastly overstates the function of currency and transmits this mistake to the estimates of the SE.

- There is also a long term trend decline in income velocities of broad monetary aggregates, which is true for all countries except Korea, where it is relatively stable and two Eastern European countries, which are special cases due to transition. During the past three decades the scissor between velocity of currency and that of broad monetary aggregates widened: today in most industrial countries M2 velocity is merely 3 to 10 percent of currency velocity. In Iceland and the UK it is merely about 2 percent. Hence, estimates based on currency velocity can be reduced by this large proportion if one gives M2 velocity preference on the grounds discussed above. Years ago, there was an intense debate on estimates of the shadow economy for Canada, summarized by Hill (2002). On the basis of this debate Hill suggested the income velocity of currency to lie in a range of 2 to 4. Like Klovland (1984) he also proposed to provide several estimates. Thus, he argued that Schneider's estimate for the Canadian underground economy in 1996 of about 15 percent of official GDP would instead be 2 – 4 percent of GDP (Hill, 2002,p, 1649)., which incidentally corresponds well to a later estimate of the maximum potential underground activity by Statistics Canada (2006). Given the strong long term trend decline in income velocities of broad monetary aggregates Hill's suggested velocity range would correspond today to a range of 1-3. And this corresponds well to our first scenario, table 9, below.

- Non-cash payments are used for transactions in the SE for several reasons: The SE will adapt to regulations preventing money laundering through elaborate means to circumvent these rules. The sheer number of electronic payments may prevent a gapless control and auditing, which may also prove too expensive to be pursued.

- Velocities jump largely from country to country even among otherwise similar ones. These differences are not well understood and have thus not been clarified. There are a few analyses of velocity (e.g. Porter and Judson, 1996), which identify major determinants, such as the interest rate, inflation, ratio of revenue to GDP as a proxy for underground activity, violent crime, noncash-payments, ATMs, and largest denomination of domestic currency in circulation. Nearly all of these variables turn out to be statistically significant with expected signs. But differences in these determinants between countries such as, for instance, UK, France, and Germany appear to be minor. And even though, for instance, the use of noncash-payments is higher in the UK than in Germany, the reasons for this are unclear and we still have little explanation for the large velocity differences.

- An own analysis of currency velocity largely confirmed the findings of Porter and Judson (1996), but is also not able to solve our problem: specifically, we ran for our sample a regression of currency velocity (with currency being adjusted for currency holdings abroad) against real GDP per capita in purchasing power parity, the short term interest rate, CPI inflation, the ratio of total government revenues to GDP, business cost of corruption, administrative burden, organized crime, dummy for frequency of wage payments, dummy for the largest denomination of domestic currency in circulation, and credit cards per capita. The total number of countries that have these data is 26 and the regression performs quite well, explaining about 82 percent of the total variation in currency velocity. Statistically significant factors, that increase velocity, are the interest rate and inflation (because they are the opportunity cost of holdings currency), frequency of wage payments and credit cards per capita (because they both lower currency demand and thus increase velocity). All other independent variables are statistically insignificant, although most of them have the expected sign. This analysis provides at least one hint as to why velocities differ so dramatically between otherwise similar countries: Credits cards per capita are much higher in the UK than either in France or Germany. But again, this does not clarify why this is so.

- Given these facts, we produced the following velocity assumptions: First we established clusters of countries which we consider relatively similar. These are EMU and industrial countries, on the one hand, and other developing countries, including our eastern European counties, on the other hand. Thus, we used averages of velocities of these two country groups. Second, owing to the trend in

velocities only the last available year 2007 was used. Third, from the above it appears that currency is much more an extreme than M2. Hence, our range of velocities used to calculate three scenarios is given by M2 velocity, on the one end, and a weighted currency-M1 velocity, where M1 is weighted 75% and currency 25%, on the other hand. These latter weights allowed to reproduce the very large estimated size of the SE for Germany in 2007 calculated by Schneider et al. (2010), namely 16.7% of official GDP. Also with this velocity assumption the averages of the estimated SE sizes are roughly equal in both studies regarding those countries for which estimates were produced here. Three scenarios were thus calculated:

- scenario 1: income velocity of M2 (table 9),
- scenario 2: income velocity of M1, (table 10),
- scenario 3: income velocity of M1 and currency, where M1 velocity is weighted 75% and currency velocity is weighted 25% (table 11).

For each country in tables 9-11 the average velocity of the group to which it belongs was used. Without using averages, the differences in the estimates of the SE would be implausibly large among otherwise similar countries due to jumps in the respective velocity from country to country. Hence, it is surprising how in studies which produce estimates of the SE for many countries, these estimates are not fluctuating widely, although the velocities of these countries are extremely different. Presumably, these studies used either an average velocity of all countries or they applied the velocity of one country for all. But the approach chosen is not explained.

Finally, monetary aggregates for which velocities were calculated, i.e. currency and M1, were both adjusted for estimated currency holdings abroad, meaning that velocities are slightly higher than without this adjustment.

Appendix 4: Which velocity assumption is consistent with the micro evidence?

We can compare the resulting estimates of the size of the SE with micro evidence from surveys and other sources. The following summary of selected micro evidence, irrespective of the source, suggests for the industrial countries that shadow economic activity, including crime related activity, has merely a potential maximum of up to a few percent of GDP. Hence, this corresponds on average best to our scenario 1 and thus to income velocity of M2 (table 9).

Size of crime related activities:

Statistics Canada (2006) cites evidence of the early 1990s for several countries:
- For Canada drug related activities were estimated at 0.3% to 0.6% of GDP. To this Statistics Canada was adding an allowance for other illegal goods and services to arrive at an estimated 1% of GDP for illegal production and services.
- For France evidence is cited that illegal activity amounted to 0.1% of GDP.
- For the USA illegal activity was estimated at 1.5% of GDP noting that more things are illegal in the US than in many other OECD countries and that drugs is still essentially an American problem. Derek Blades of the UN commission of Europe is cited: “For these reasons it can be asserted with some degree of confidence that for most OECD countries the inclusion of illegal production in GDP could not possibly add more than 1% and, on the evidence from France, probably much less than this.”
- For Germany the damage of illegal activity is estimated at 0.4% of GDP (11 billion Euros in 2008, see Bundeskriminalamt (2008), p. 64).

This suggests that the estimates of crime related shadow economic activity shown in table 9, which is based on M2 velocity, are already relatively high, although this is the lowest velocity of the discussed range. Hence, to obtain estimates of the crime related shadow economy - using the money demand method - consistent with the micro evidence suggests using a velocity of M2 or lower.

Plausibility calculations of shadow economic activity:

Since the 1990s Statistics Canada performed an item by item analysis of potentially missing underground transactions and concluded that a maximum potential for the SE in Canada would be 5.2 percent of official GDP (Statistics Canada, 2006). This consists of a maximum of 2.7 percent value of underground production (which, however, is not actually missing because otherwise it would be added to official GDP as stressed by Statistics Canada), a maximum of 1 percent of illegal production activity, and a maximum of 1.5 percent of undeclared income for tax purposes which is nevertheless recorded for national accounts.

For Germany simple plausibility calculations show that estimates of the SE of 16 percent of official GDP are beyond credibility. For 2010 this equals about 390 billion Euros which is the value of 1000 soccer stadiums each year of the size of that in Munich of 70000 seats built in 2005 at a cost of 350 million Euros. This estimate is also equivalent to 9070 Euros earned in the SE each year by each employed and unemployed person (43 million people). Or at an average wage of 10 Euros per hour this means that each of these 43 million people would work in the SE each year 907 hours equivalent to working each of the 52 weekends per year both days almost 9 hours. Since for Germany less than 10% of the population in the 18-74 year group stated that they have carried out black market activities the number of people would reduce to about less than 7 million but this includes those who worked only once or very few times in the shadow. Thus, the number of people working regularly underground must be much smaller. Just to make an assumption we assume this number to be half, i.e. 3.5 million. If black market activities in a narrow sense constitute about 50% of total shadow economic activity (an implicit assumption by Schneider and Enste, 2006, p. 188), i.e. .5*390 = 195 billion Euros, then each of these about 3.5 million people would need to earn about 56000 Euros a year or 4640 Euros each month. But there would be an additional 195 billion Euros earned by other entities including crime. Considering a) how well companies are monitored by tax investigators and by the special police force against shadow economic activity, b) that the number of persons is relatively small who are related to crime, and c) the unwillingness of people to take the relatively high risk of being detected caused, for instance, by the invitation of the State to report anonymously tax offenses, the resulting number of entities earning these 195 billion Euros is accordingly small. Even if it would be as large as 1 million, just to make an assumption, each of them would earn 190000 Euros year after year unnoticed by the auditors and special police.

Even if this would be credible, a production of this magnitude (1000 soccer stadiums each year) could not go unnoticed by the population. And even the special police force (“Finanzkontrolle Schwarzarbeit”) established by the Finance Ministry in 2004 of nearly 7000 officers at a cost of about 500 million Euros per year was not able to detect this kind of production but only a tiny fraction of it, namely about 600 million Euros in alleged damages per year including fines (0.015% of the 390 billion Euros), of which, however, only about 50 million Euros were actually raised (Deutscher Bundestag, 2008). For further plausibility checks concerning Germany see Koch (2007) and Graf (2007). Koch (2007) provides a detailed assessment that also shows that the estimate of 16% SE relative to official GDP for Germany is not credible.

Micro survey evidence:

The national surveys of living standards and working conditions of the population mostly include questions regarding additional business, part-time work or moonlighting, but such work includes legal and officially registered and taxed part time work so it cannot be interpreted as black market or shadow economic activity.

However, there are few valuable surveys concerned only with shadow economic activity. For Denmark, Norway, and Sweden, Germany and the United Kingdom, the Rockwool Foundation carried out such a survey in 2001, which was repeated for Germany in 2004, 2005 and 2006 (Pedersen, 2003, Feld and Larsen, 2005, and Feld, 2010). Black market activities as a ratio to official GDP were estimated for Denmark to have been 1.8%, Norway 1.1%, Sweden 1.0%, Germany 1.3% and UK, 0.6%.

The proportion of the population in the 18-74 age group who stated that they have carried out black activities within the last 12 months (which may have been only once) was between 20,3% in Denmark, 17.3% in Norway, 11.1% in Sweden, 10.4 in Germany and 7.8% in the UK.

The results for Germany in the years 2004-2006 show a decreasing trend in this participation to below 9% as well as in the estimated ratio to official GDP. This ratio was estimated for 2001 at 1.35%, for 2004 at 1.01%, and for 2006 below 1%. However, in Feld and Larsen (2006) and in Feld (2010) larger ratios of estimated black activities to GDP are also presented, namely 4% in 2001 decreasing to 2.5% in 2006. Graf (2007) criticizes the reason for these higher numbers, namely the assumption of the authors that had black market activities taken place in official markets, their value could have been three times as high, as incorrect due to the budget constraints of market participants. Also the emphasis by Feld and Larsen (2005) that their estimates may be lower limits of the black market economy are criticized, because:

- it is not clear that respondents underreport activities,
- there are questions regarding the role of answers in the estimates where respondents may have been active in the black market economy only once or very few times in a year,
- one cannot exclude that respondents included in their answers activities, which are not black market activities such as engagements in neighborly help, membership associations, honorary offices etc., (Graf 2007, p. 199).

Germany established in 2004 a special police force of nearly 7000 officers with the sole task of uncovering shadow economic activity (the so-called “Finanzkontrolle Schwarzarbeit”) as a subunit of customs under the supervision of the Finance Ministry.[28] The costs of this police force are about 500 million Euros per year and despite large monetary targets for each officer concerning underground activity to be uncovered the final revenues generated by this task force for the pension, health insurance and tax system are miniscule: According to an analysis by the national court of auditors (Deutscher Bundestag, 2008) the pension system received only 1.7% of the allegedly uncovered losses, the tax system received 4.4% of uncovered losses and of the levied fines only 22% were actually paid. This suggests that the police, bureaucracies and courts were busy but with little result.

Overall the court of auditors estimates that only about 8% of all losses allegedly uncovered by the task force (of about 600 million Euros in 2006 including fines) is generated as actual revenue (about 50 million Euros in 2006). But this does not account for the considerable but unknown costs incurred by the justice system due to the large number of initiated prosecutions which failed in courts and other costs such as lost working hours and lost reputation of businesses and persons that were indicted but found innocent. Nobody estimated these costs. There is no evidence about the efficacy of this task force. The court of auditors criticized the supervisory authority, the Finance Ministry, for not initiating an analysis of the efficacy of this expensive unit. The statistics prepared by the unit do not allow inferences about the size of the total shadow economy.

Appendix 5: Sensitivity scenarios II and III

[28] The officers were former border customs officers but in this function redundant after accession of Eastern European countries to the EU.

Table 10: Scenario II of the size of the shadow economy (SE) and individual causes (using average M1 velocity) 1/
(in percent of official GDP)

	Administrative burden (wef605)	Tax burden (ttrgdp)	Social security burden (ssccgdp)	Quality of public services (wef508)	Non "crime-" related SE	"Crime" shadow economy (wef111)	Total Shadow Economy
Australia	0.00	0.84	n.a.	1.06		2.4	
Austria	0.11	0.71	0.26	1.13	2.2	1.5	3.7
Belgium	0.90	1.06	0.34	1.85	4.2	2.7	6.9
Bulgaria	n.a.	n.a.	n.a.	2.72		9.8	
Canada	0.00	0.00	0.00	0.00	0.0	5.7	5.7
Cyprus	n.a.	n.a.	n.a.	6.59		7.2	
Czech Republic	n.a.	n.a.	n.a.	n.a.		7.2	
Denmark	0.00	0.00	0.00	0.00	0.0	0.6	0.6
Estonia	1.58	n.a.	n.a.	0.72		3.4	
Finland	0.00	0.43	0.22	0.69	1.3	0.6	1.9
France	0.07	0.29	0.08	0.74	1.2	1.8	3.0
Germany	1.34	0.38	0.34	0.88	2.9	2.4	5.4
Greece	0.00	1.82	0.64	0.97	3.4	4.4	7.8
Hungary	n.a.	n.a.	n.a.	n.a.	0.0	6.0	
Iceland	0.00	1.05	0.16	0.94	2.1	0.7	2.8
Ireland	1.66	1.56	0.22	1.78	5.2	3.3	8.5
Italy	0.00	0.71	0.19	2.40	3.3	5.9	9.2
Japan	0.93	1.06	0.91	2.61	5.5	7.8	13.3
Korea, Republic of	0.74	1.45	0.67	1.93	4.8	5.3	10.1
Latvia	0.07	n.a.	n.a.	0.93		4.8	
Lithuania	0.00	n.a.	n.a.	1.12		5.3	
Luxembourg	0.00	1.14	0.16	0.94	2.2	1.9	4.2
Malta	n.a.	n.a.	n.a.	1.73		3.5	
Mexico	1.48	0.28	n.a.	0.53		6.8	
Netherlands	0.10	1.23	0.85	1.44	3.6	4.9	8.5
New Zealand	0.00	0.76	n.a.	1.18		2.4	
Norway	0.55	0.57	0.19	1.29	2.6	1.3	3.9
Poland	0.00	0.74	n.a.	1.68		6.8	
Portugal	1.38	1.60	1.26	1.42	5.7	2.2	7.9
Romania	0.52	n.a.	n.a.	1.37		5.9	
Slovak Republic	1.44	1.20	1.33	2.37	6.3	7.4	13.7
Slovenia	0.04	n.a.	n.a.	2.34		4.8	
Spain	1.17	0.62	0.36	0.91	3.1	3.2	6.3
Sweden	0.07	0.53	0.64	0.88	2.1	1.3	3.4
Switzerland	0.00	0.39	0.42	0.74	1.5	2.2	3.8
Turkey	0.29	1.38	0.44	1.06	3.2	4.8	8.0
United Kingdom	0.85	1.06	0.17	1.36	3.4	3.7	7.1
United States	0.04	0.55	0.05	0.95	1.6	4.5	6.1

1/ Velocity assumption of currency used in the unofficial economy: average of M1 velocities of two country groups: for country group industrial countries, incl. EMU: 3.49; for developing countries, incl. Eastern Europe: 5.33. See also appendix 3 and the note in table 9.
Source: own calculations.

Table 11: Scenario III of the size of the shadow economy (SE) and of individual causes (using 3/4 average M1 velocity and 1/4 average currency velocity) 1/
(in percent of official GDP)

	Administrative burden (wef605)	Tax burden (ttrgdp)	Social security burden (ssccgdp)	Quality of public services (wef508)	Non "crime-" related SE	"Crime" SE (wef111)	Total Shadow Economy	Schneider (2010) av. 99-07
Australia	0.0	2.6	n.a.	3.3		7.6		14.6
Austria	0.4	2.2	0.8	3.5	6.9	4.6	11.5	9.8
Belgium	2.8	3.3	1.1	5.8	12.9	8.5	21.5	22.5
Bulgaria	n.a.	n.a.	n.a.	5.9		21.2		38.5
Canada	0.0	0.0	0.0	0.0	0.0	17.8	17.9	16.3
Cyprus	n.a.	n.a.	n.a.	14.3		15.6		29.4
Czech Republic	n.a.	n.a.	n.a.	n.a.		15.7		19.8
Denmark	0.0	0.0	0.0	0.0	0.0	2.0	2.0	18.2
Estonia	3.4	n.a.	n.a.	1.6		7.3		40.3
Finland	0.0	1.4	0.7	2.2	4.2	1.8	5.9	18.5
France	0.2	0.9	0.3	2.3	3.7	5.7	9.3	15.4
Germany	4.2	1.2	1.1	2.7	9.2	7.5	16.7	16.1
Greece	0.0	5.7	2.0	3.0	10.7	13.7	24.4	29.9
Hungary	n.a.	n.a.	n.a.	n.a.	0.0	13.1		25.8
Iceland	0.0	3.3	0.5	2.9	6.7	2.2	8.8	16.2
Ireland	5.2	4.9	0.7	5.5	16.2	10.3	26.5	16.0
Italy	0.0	2.2	0.6	7.5	10.3	18.2	28.5	27.2
Japan	2.9	3.3	2.8	8.1	17.2	24.3	41.4	11.4
Korea, Republic of	1.6	3.2	1.4	4.2	10.4	11.5	21.9	28.2
Latvia	0.1	n.a.	n.a.	2.0		10.4		41.7
Lithuania	0.0	n.a.	n.a.	2.4		11.4		31.9
Luxembourg	0.0	3.6	0.5	2.9	7.0	5.9	12.9	9.9
Malta	n.a.	n.a.	n.a.	5.4		10.9		27.0
Mexico	3.2	0.6	n.a.	1.2		14.8		30.2
Netherlands	0.3	3.8	2.6	4.5	11.2	15.1	26.3	13.0
New Zealand	0.0	2.4	n.a.	3.7		7.4		13.2
Norway	1.7	1.8	0.6	4.0	8.1	4.0	12.1	19.5
Poland	0.0	1.6	n.a.	3.6		14.7		28.0
Portugal	4.3	5.0	3.9	4.4	17.6	7.0	24.6	22.5
Romania	1.1	n.a.	n.a.	3.0		12.8		36.3
Slovak Republic	3.1	2.6	2.9	5.1	13.7	15.9	29.7	19.7
Slovenia	0.1	n.a.	n.a.	5.1		10.5		28.0
Spain	3.7	1.9	1.1	2.8	9.5	10.1	19.6	22.9
Sweden	0.2	1.6	2.0	2.7	6.6	4.1	10.7	19.6
Switzerland	0.0	1.2	1.3	2.3	4.8	6.9	11.7	8.7
Turkey	0.6	3.0	1.0	2.3	6.9	10.4	17.3	32.9
United Kingdom	2.6	3.3	0.5	4.2	10.7	11.4	22.1	12.9
United States	0.1	1.7	0.2	2.9	4.9	14.0	18.9	8.8

1/ Velocity assumption of currency used in unofficial transactions: 3/4 M1 velocity and 1/4 currency velocity:
for country group industrial countries, incl. EMU: 10.85; for developing countries, incl. Eastern Europe: 11.56.
See the explanations given in appendix 3 and the note in table 9.
Source: own calculations.